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United States Department of the Interior

FISH AND WILDLIFE SERVICE
911 NE 11th Avenue
Portland, Oregon 97232-4181

IN REPLY REFER TO:

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In Reply Refer To:
1-1-94-F-70

Memorandum

To: Regional Director, U.S. Bureau of Reclamation
Sacramento, California

From: Regional Director, U.S. Fish and Wildlife Service
Region 1, Portland, Oregon

Subject: Transmittal of Draft Jeopardy Biological Opinion and Conference Opinion on Effects of Long-term Operation of the Central Valley Project and State Water Project on the Threatened Delta Smelt, Proposed Threatened Sacramento Splittail and Proposed Delta Smelt Critical Habitat.

This transmits the draft Biological Opinion and Conference Opinion on the subject referenced above for your review and comment. This Biological Opinion and Conference Opinion are based on the project description provided by the Bureau of Reclamation, including requirements applicable to the operation of both projects and consistent with water quality standards proposed by the U.S. Environmental Protection Agency (EPA).

The State of California has begun a process to adopt water quality standards which will be submitted to EPA for review and approval under the Clean Water Act and which will, upon approval, replace current EPA standards. EPA will consult with the Fish and Wildlife Service (Service), pursuant to section 7 of the Endangered Species Act, in connection with its review of the proposed State standards. In the course of that consultation, the provisions of this Biological Opinion and Conference Opinion will be reexamined. The State also intends to conduct a proceeding to allocate responsibility among water right holders in the Bay-Delta watershed for meeting the water quality standards. Reexamination of this Biological Opinion and Conference Opinion is anticipated following this action as well.

In connection with these subsequent reviews, the Service has discretion to modify the terms of the Biological Opinion based on new State water quality standards and its water right actions. The Service intends, consistent with its responsibility to provide protection to listed species and their habitat, to exercise this discretion to maximize consistency between the terms of this Biological Opinion and Conference Opinion and the actions taken by the State so as to eliminate or minimize additional requirements which may be placed upon the projects.

If you have any questions regarding this matter, please contact Wayne White, California State Supervisor, at (916) 978-4613.

Sincerely,

Regional Director

Attachment

In Reply Refer To:
1-1-94-F-70

Memorandum

To: Regional Director, U.S. Bureau of Reclamation
Sacramento, California

From: Regional Director, U.S. Fish and Wildlife Service
Region 1, Portland, Oregon

Subject: Formal Consultation and Conference on Effects of Long-term Operation of the Central Valley Project and State Water Project on the Threatened Delta Smelt, Proposed Threatened Sacramento Splittail and Proposed Delta Smelt Critical Habitat

This responds to your request of September 6, 1994, for formal consultation with the U.S. Fish and Wildlife Service (Service) pursuant to section 7(a)(2) of the Endangered Species Act of 1973, as amended (Act), on the effects of the long-term operation of the Central Valley Project (CVP) and State Water Project (SWP) on the delta smelt (*Hypomesus transpacificus*). The delta smelt was federally listed as a threatened species on March 5, 1993 (Service 1993a). Included with this request for formal consultation was a biological assessment entitled: "Effects of the Central Valley Project (CVP) and State Water Project (SWP) on Delta Smelt and Sacramento Splittail", prepared by the California Department of Water Resources (DWR) and the U.S. Bureau of Reclamation (Reclamation)(DWR and Reclamation 1994).

This biological opinion addresses effects of the long-term combined operations of the CVP and SWP on the delta smelt. On January 6, 1994, a revised proposed rule to designate critical habitat for the delta smelt (Service 1994a) and a proposed rule to list the Sacramento splittail (*Pogonichthys macrolepidotus*) as a threatened species (Service 1994b) were published in the Federal Register. This biological opinion also incorporates a conference opinion prepared pursuant to 50 CFR 402.10, which addresses combined project effects on proposed delta smelt critical habitat and the proposed threatened Sacramento splittail. Should these listing actions be finalized as proposed, the Service intends to adopt the conference opinion as the biological opinion for combined project effects on delta smelt critical habitat and the Sacramento splittail. When the conference opinion is adopted in this manner, it would satisfy Reclamation's consultation requirements. This biological opinion does not address all of the interrelated and interdependent effects of the CVP/SWP action. Effects of CVP/SWP operations on the endangered bald

eagle (*Haliaeetus leucccephalus*), endangered California clapper rail (*Rallus longirostris obsoletus*), and endangered salt mouse harvest mouse (*Reithrodontomy raviventris*) have been addressed in another biological opinion (Service 1993b). Effects of the CVP in the Friant Division service area were also addressed in a separate biological opinion (Service 1991a). The Service has issued several other biological opinions pertaining to the CVP (Service 1993c, 1994c). A biolcgical opinion has also been issued by the Service to EPA regarding Bay-Delta water quality standards. In a memorandum dated April 8, 1993, Reclamation agreed to consult with the Service on other federally listed endangered and threatened species in CVP service areas. Effects of the CVP and SWP on the threatened giant garter snake (*Thamnophis gigas*) are being addressed in a separate consultation (Service 1994c).

CONCURRENT PROPOSED ACTIONS

The Service will be issuing final rules regarding the listing of the Sacramento splittail as a threatened species, and the designation of critical habitat for the delta smelt concurrently with the issuance of this biological opinion.

EPA is in the process of promulgating water quality standards for the Sacramento-San Joaquin river estuary (Estuary) that will place the 2 ppt isohaline (X2) at Roe Island, Chipps Island, and Collinsville for varying numbers of days dependent on a previous months flow index occurring from February 1 through June 30. These standards provide outflows that will transport larval delta smelt to suitable rearing habitat in Suisun Bay and will maintain that habitat under conditions which are not influenced by Federal and State pumps.

Although EPA is proposing water quality standards to fully protect the Bay-Delta, neither EPA nor the Service anticipates immediate full implementation of these standards. Full implementation will occur over time.

Consideration of any future biological opinions based on new or re-initiated consultation will recognize three major initiatives that will shape the dynamics of future estuarine conditions for delta smelt. First, in accordance with a Framework Agreement (1994) between the Governor's Water Policy Council of the State of California (Council) and the Service, National Marine Fisheries Service (NMFS), EPA, and Reclamation (collectively known as "Club Fed"), the State Water Resources Control Board (SWRCB) will seek agreement with DWR and Club Fed to operate the CVP and SWP to make an equitable contribution to meet the revised water quality standards beginning in calendar year 1995. This will occur while water right decisions are under way to allocate responsibility among water right holders in the Bay-Delta watershed, or alternatively the SWRCB may adopt water quality standards which provide for phased implementation. Second, section 7(a)(1) of the Act imposes an affirmative obligation on Federal agencies to carry out programs for the conservation (recovery) of listed species. With the forthcoming issuance of a draft Delta Native Fishes Recovery Plan, the Service expects that

participating and affected local, State, and Federal agencies will fulfill their responsibilities by assisting in the completion of tasks and objectives in the Recovery Plan. Third, and related to number two above, the scheduled renewal or reopening of water contracts and licenses (such as, reopened or expired Federal Energy Regulatory Commission (FERC) licenses, expired CVP water contracts) will provide an additional opportunity under section 7(a)(1) and 7(a)(2) of the Act to implement Recovery Plan objectives and meet EPA's water quality standards. Collectively, these initiatives will result in a phased improvement to water quality-based habitat requirements for the delta smelt and Sacramento splittail. Accordingly, the Service anticipates that adverse modification or destruction of critical habitat would be avoided by the CVP and SWP through implementation of the above described initiatives.

CVP AND SWP PROPOSED ACTION

The following sources of information were used to develop this biological opinion: (1) the biological assessment transmitted with the request for formal consultation; (2) discussions with Reclamation, DWR, EPA, and the California Department of Fish and Game (DFG) at several informal meetings; (3) references cited in this biological opinion; (4) miscellaneous materials provided by Reclamation, DWR, EPA, and DFG during the consultation process; and (5) unpublished information in Service files.

BIOLOGICAL OPINION

It is our biological and conference opinion that the proposed long-term combined CVP and SWP operations are likely to jeopardize the continued existence of the threatened delta smelt and the proposed threatened Sacramento splittail, and adversely modify proposed critical habitat for the delta smelt. "Jeopardy" is defined at 50 CFR 402.02 as any action that would be expected to reduce appreciably the likelihood of both the survival and recovery of a listed species. "Destruction or adverse modification of critical habitat" is defined at 50 CFR 402.02 as a direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species.

DESCRIPTION OF THE PROPOSED ACTION

As described in DWR and Reclamation (1994), the project action is defined as those measures required by the SWRCB Water Rights Decision 1485 (SWRCB D-1485) as modified by the requirements of the February 12, 1993, NMFS winter-run chinook salmon biological opinion (NMFS 1993). The project action is also defined as those actions that implement management decisions agreed upon in the August 2, 1994, Framework Agreement (Fourteen-Agency 1994). A detailed description of facilities and historic and proposed operations of CVP and SWP are described in DWR and Reclamation (1994). Additional information on CVP and SWP facilities and operations can be found in Reclamation (1992), DWR and Reclamation (1993), NMFS (1993), and Service (1993b).

DRAFT

NMFS Biological Opinion of February 12, 1993

The reasonable and prudent alternative and incidental take statement terms and conditions from the NMFS biological opinion of February 12, 1993, which are incorporated into the proposed operations, are summarized in the following list:

(1) Reasonable and prudent alternative

(a) Reclamation to use at least 90 percent probability of exceedance forecast for determining deliverable water.

(b) Shasta Reservoir to retain a minimum of 1.9 MAF storage as of September 30.

(c) Keswick Dam minimum release of 3,250 cfs from October 1 through March 31.

(d) Additional ramping restrictions on Keswick Dam release reductions from July 1 to March 31.

(e) Daily average water temperature not to exceed 56° F degrees at Bend Bridge from April 15 through September 30; 60° F from October 1 through October 31.

(f) Red Bluff Diversion Dam Gates raised through April 30, 1993, with conditional provision for closure up to 10 days. Gates must be raised beginning November 1, 1993.

(g) Delta Cross Channel closed February 1 through April 30.

(h) Delta Cross Channel conditional closures beginning October 1, through January 31, based on real-time monitoring for presence of winter-run.

(i) Control of QWEST through operation of the export facilities from February 1 through April 30 so that 14-day running average exceeds zero cfs, and 7-day running average exceeds -1,000 cfs.

(j) Control of QWEST through operation of the export facilities from November 1 through January 31 so that 14-day running average exceeds -2,000 cfs, and 7-day running average exceeds -3,000 cfs.

(k) Continue and expand monitoring of winter-run in the Delta to serve as a basis for real-time management of Delta Cross Channel.

(l) Monitor entrainment loss of winter-run in Rock Slough intake of Contra Costa Canal.

(m) Monitor incidental take at Tracy and Byron pumping facilities.

(2) Incidental take terms and conditions

(a) Continue and expand temperature monitoring on upper Sacramento River.

(b) Provide for NMFS review of operations forecast for initial water allocation and all subsequent updates.

(c) Operate Spring Creek Debris Dam to minimize exposure of winter-run to toxic metal concentrations.

(d) Prevent entrapment of winter-run adults in Keswick Dam stilling basin.

(e) Monitor nearshore areas during ramping down of Keswick Dam releases from 4,000 to 3,250 cfs.

(f) Investigate and correct any adverse effects of air entrainment at Tehama-Colusa Fish Facilities.

(g) Prevent entrainment of winter-run at intakes of pumps at Red Bluff Diversion Dam.

(h) Prevent stranding of winter-run within East Sand Slough of Lake Red Bluff during drawdown.

(i) Limit incidental taking at Sacramento-San Joaquin Delta (Delta) export facilities to one percent of estimated out-migrating smolt population. This amounts to a limit of 2,700 during 1993 operations.

(j) DWR must implement a program to investigate effects of Suisun Marsh Salinity Control Structure on winter-run.

(k) Reclamation and DWR must insure fish collection facilities are fully staffed for monitoring and screens fully operational when pumping plants are in operation.

(l) Reclamation and DWR will develop and implement a demonstration screening program.

(m) Reclamation and DWR will provide daily, weekly, and annual reports as specified, of operations, temperatures, and hydrologic conditions, and the results of the monitoring program.

(n) Reclamation will establish a working operations and management oversight group to address implementation of the reasonable and

prudent alternatives.

(o) Reclamation and DWR will develop new methods for estimating winter-run salvage and losses that are acceptable to NMFS.

Central Valley Project and State Water Project

Two major interbasin water delivery systems, the CVP and the SWP, divert water from the southern portion of the Sacramento River/San Joaquin River delta (Delta) (Figure 1). Both projects include major reservoirs north of the Delta, and both transport water released from storage to areas south and west of the Delta.

The CVP is composed of some 20 reservoirs with a combined storage capacity of about 11 million acre-feet (AF), eight power plants and two pumping/power-generating plants with a maximum capacity of about two million kilowatts, and about 500 miles of major canals and aqueducts (Figure 1). These various facilities are generally operated in coordination as a single project. Authorized project purposes include flood control and navigation; provision of water for irrigation and domestic uses; fish and wildlife protection, restoration, and enhancement; and power generation. However, not all facilities are operated to meet each of these purposes. Flood control is not an authorized purpose of the CVP's Trinity River Division, for example. The primary purpose of the Federal CVP is to provide water for irrigation throughout California's Central Valley. Recent legislation included in the Central Valley Project Improvement Act (CVPIA) has modified this purpose through section 3402 to include fish and wildlife mitigation, protection, and restoration, as purposes equal in priority to irrigation and domestic uses, and fish and wildlife enhancement as a purpose equal in priority to power generation.

Figure 1 shows major features of the CVP including Shasta and Keswick dams and Shasta Reservoir on the Sacramento River; Trinity and Lewiston dams and Clair Engle Reservoir on the Trinity River; Folsom and Nimbus dams and Folsom Reservoir on the American River; New Melones Dam and Reservoir on the Stanislaus River; Friant Dam and Millerton Reservoir on the San Joaquin River; the Tracy Pumping Plant; the Contra Costa Canal; and the Delta-Mendota, Friant-Kern, and Madera canals in the San Joaquin Valley. Other features including San Luis Reservoir, O'Neill Forebay, and a portion of the California Aqueduct (San Luis Canal) are joint facilities also owned by the SWP. The Delta facilities and project operations will be described in greater detail below.

The SWP stores and distributes water for agricultural, municipal, and industrial uses in northern California, the San Francisco Bay area, the San Joaquin Valley, and southern California. Other project functions include flood control, water quality maintenance, power generation, recreation, and fish and wildlife enhancement. Figure 1 shows major features of the SWP including Oroville Dam and Reservoir, and Thermolito Dam and Afterbay on the

Feather River; the North and South Bay aqueducts; the Harvey O. Banks Delta Pumping Plant and Clifton Court Forebay near Tracy; the California Aqueduct, which runs south from the Delta through the San Joaquin Valley and into southern California; and Pyramid, Perris, and Castaic reservoirs along the California Aqueduct.

Delta Facilities

The CVP and SWP use the Sacramento River and channels in the Delta to transport water to export pumping plants in the south Delta (Figure 2a). The CVP's Tracy Pumping Plant, about five miles north of Tracy, consists of six pumps including one rated at 800 cubic feet per second (cfs), two at 850 cfs, and three at 950 cfs. Maximum sustained pumping capacity is about 4,600 cfs, the nominal capacity of the Delta-Mendota Canal at the pumping plant. The Tracy Pumping Plant is located at the end of an earth-lined intake channel about 2.5 miles long. At the head of the intake channel, louver screens that are part of the Tracy Fish Protection Facility and effective on targeted species, intercept fish which are then collected and transported by tanker truck to release sites away from the pumps.

Other CVP facilities in the Delta include the Delta Cross Channel and the Contra Costa Canal (Figure 2a). The Delta Cross Channel is a gated diversion channel in the Sacramento River near Walnut Grove and Snodgrass Slough. When the gates are open, water is diverted from the Sacramento River through natural channels of the lower Mokelumne and San Joaquin rivers toward the pumping plants in the south Delta. The Contra Costa Canal originates at Rock Slough, about four miles southeast of Oakley, and terminates after 47.7 miles at Martinez Reservoir. Historically, diversions at the unscreened Rock Slough facility (Contra Costa Canal Pumping Plant No. 1) have ranged from about 50 to 250 cfs. The canal and associated facilities are part of the CVP, but are operated and maintained by the Contra Costa Water District (CCWD).

The SWP's Harvey O. Banks Delta Pumping Plant (Banks Pumping Plant), in the south Delta, about 12 miles northwest of Tracy, consists of 11 pumps, including two rated at 375 cfs capacity, five at 1,130 cfs capacity, and four at 1,067 cfs capacity (Figure 2a). Water is pumped into the California Aqueduct, which has a nominal capacity of 10,300 cfs at Banks Pumping Plant. A one-mile, open intake channel conveys water to the Banks Pumping Plant from Clifton Court Forebay, a 31,000 AF reservoir which provides storage for off-peak pumping and moderates the effect of the pumps on the fluctuation of flow in adjacent Delta channels. Water enters Clifton Court Forebay and then passes through John E. Skinner Fish Protective Facility (Skinner Fish Facility), which intercepts fish that would otherwise be entrained into the pumps and California Aqueduct. As at the Tracy Fish Facility, fish captured at the Skinner Fish Facility are relocated elsewhere in the Delta.

Other DWR facilities in and near the Delta include the North Bay Aqueduct (NBA), the Suisun Marsh Salinity Control Structure (SMSCS), Roaring River diversion, and several temporary barriers in the south Delta.

The NBA allows the SWP to meet project entitlements in Napa and Solano counties with ultimate scheduled deliveries expected to be 67,000 AF annually. The intake for the NBA is on Barker Slough and maximum pumping capacity is about 175 cfs with daily pumping rates ranging between 0 and 90 cfs.

The SMSCS spans Montezuma Slough near Collinsville. Operation of the structure restricts the upstream movement of salty water from Suisun Bay during flood tide while allowing the normal flow of freshwater from the Sacramento River during ebb tides. This action changes the effects of upstream diversions by the CVP and SWP, other small agricultural diversions, and decreases salinities in Suisun Marsh where water is diverted onto private lands and lands owned by DFG.

The Roaring River diversion and distribution system intake is the largest diversion point on Montezuma Slough in Suisun Marsh. The intake consists of eight 60-inch culverts just to the north of the original Roaring River confluence with Montezuma Slough. Operation and screening of this intake is described in more detail below.

DWR's existing South Delta Temporary Barriers Project consists of seasonal installation and removal of temporary rock barriers at three locations in the south Delta. Barrier location and operation of these barriers is described in more detail below. DWR will be consulting on a fourth temporary barrier in Grantline Canal.

Operations of Delta Facilities

This section summarizes information on CVP and SWP operations that is presented in greater detail in DWR and Reclamation (1994).

Delta Export Facilities. The Delta acts as a conduit for natural river flows and reservoir storage to the CVP and SWP facilities in the south Delta which export water to the projects' service areas (Figure 2a). The Contra Costa Canal and the NBA supply water to users in the northwestern San Francisco Bay and Napa Valley areas, while the Banks and Tracy pumping plants are operated to meet demands in the San Joaquin Valley, southern California, and southwestern San Francisco Bay area. CVP and SWP Delta export operations are constrained by regulatory decisions and permits, laws, and negotiated agreements. Examples include: the SWRCB D-1485, a U.S. Army Corps of Engineers (Corps) permit for the Banks Pumping Plant, the Coordinated Operation Agreement (COA) between the CVP and SWP of 1986, the NMFS biological opinion on the effects of the projects on the threatened winter-run chinook salmon, and the Service's 1994 biological opinion on the effects of the project on delta smelt. Additional constraints result from section 3406(b)(2) of the CVPIA which dedicates annually 600,000 to 800,000 AF of CVP yield for fish, wildlife and habitat restoration purposes. Refuges are allocated level II water through CVPIA. Additional level IV water may also be acquired.

Operations of the Tracy and Banks pumping plants are closely coordinated with

each other and with operations of the joint CVP and SWP San Luis Reservoir. A typical annual cycle of Delta operations begins in August or September, when storage in San Luis Reservoir is typically at its lowest level following peak spring and summer water demand in the project service areas. At this time, demand for irrigation water begins to decline, and export capacity in the Delta is increasingly devoted to refilling San Luis Reservoir. During the fall, the CVP and SWP largely transfer water stored north of the Delta (from Shasta, Clair Engle, Folsom, and Oroville reservoirs) to San Luis Reservoir; during the winter, the Tracy and Banks Pumping Plants export a combination of uncontrolled natural river flows and upstream reservoir releases for storage in San Luis Reservoir.

In past years, export pumping has continued at or near maximum rates from August through April, or until the San Luis Reservoir was full. The Tracy Pumping Plant is usually operated at or near its maximum rate of 4,600 cfs, except when restrictions are imposed by water right or endangered species requirements. Average daily diversions at the Banks Pumping Plant are generally limited to 6,680 cfs, as set forth by Corps requirements (dated October 13, 1981). However, from mid-December to mid-March, diversions at the Banks Pumping Plant may be increased by one-third of the flow of the San Joaquin River (as measured at Vernalis), if discharge from the San Joaquin River exceeds 1,000 cfs. The maximum potential diversion rate at the Banks Pumping Plant during this period is 10,300 cfs, the nominal capacity of the California Aqueduct.

The reasonable and prudent alternative in the NMFS (1993) biological opinion for winter-run chinook salmon imposed new constraints on export pumping in the late fall, winter, and early spring. From November 1 through January 31, NMFS required that project operations allow flows in the western San Joaquin River to exceed negative 2,000 cfs (based on the 14-day running average of QWEST). QWEST is a calculated discharge defined as San Joaquin River flow in the Delta near Vernalis. From February 1 through April 30, NMFS requires Delta export facilities to operate in a manner that avoids net reverse (negative) flows in the western San Joaquin River (based on the 14-day running average of QWEST).

In May, June, and July, SWRCB D-1485 limits export pumping as irrigation demands begin to increase. These demands are met by a combination of export pumping and storage withdrawals from the San Luis Reservoir. SWRCB D-1485 also established water quality standards which were designed to protect beneficial uses in the Delta and Suisun Marsh, including agriculture, municipal, industrial, and fish and wildlife uses. While such Delta standards apply throughout the year, they are most critical for operations of the CVP and SWP when balanced water conditions exist in the Delta. Balanced water conditions exist when Delta inflow equals water demand; this typically occurs from April through November. This balance may vary depending on hydrologic and storage conditions. To protect striped bass spawning, SWRCB D-1485 requires that the CVP and SWP each limit pumping to an average of 3,000 cfs during May and June, and 4,600 cfs in July. Exports can be further reduced to a mean rate of 2,000 cfs during May and June if releases for export are

exceeding natural inflow at Lake Oroville. In average or above-average runoff years, the Banks Pumping Plant would typically divert near allowable export rates during September and the first half of October to move water from Lake Oroville to San Luis Reservoir. During this period, the SWP pumps up to 195,000 AF of CVP water to replace exports lost during the May and June SWRCB D-1485 restrictions. In December through March, maximum export rates are generally required to capture uncontrolled runoff in the Delta to fill the SWP share (1,062 thousand AF) of San Luis Reservoir.

Entitlement water deliveries to SWP contractors are also maintained during these periods. Peak contractor delivery patterns during spring and summer are satisfied by direct diversions from the Delta in conjunction with releases from San Luis Reservoir and SWP reservoirs in Southern California. At times, unused Delta pumping capacity would be available to move additional water for direct delivery or into storage south of the Delta for future use.

Allocation of water supplies for a given year is based on four variables:

(1) Forecast water supplies based on the Sacramento River Index (SRI), which is the sum of measured runoff at four locations (Sacramento River near Red Bluff, Feather River inflow to Lake Oroville, Yuba River at Smartville, and American River inflow to Folsom Lake);

(2) amount of carry-over storage in Oroville and San Luis reservoirs;

(3) projected requirement for end-of-year carryover storage;

(4) SWP system delivery capability.

These criteria are meant to ensure that sufficient water is carried over in storage to protect Delta water quality the next year, to meet fishery requirements, and to provide an emergency reserve. Beginning each year in December, initial allocations of entitlement deliveries are determined based on the four criteria. Allocations are updated monthly until May, and more often if storms result in a significant increase in the Sacramento River Index. The CVPIA has produced an analysis that may lead to additional balancing in providing for the annual management of 800,000 AF of CVP yield for fish, wildlife and habitat restoration purposes. To date, management of the 800,000 AF has included:

(1) Springtime pulse flows in the Stanislaus River, and in the lower San Joaquin River.

(2) Springtime restrictions on Delta pumping and closure of the Delta Cross Channel gates.

(3) Spawning and rearing flow improvements in the mainstem Sacramento,

lower American, and Stanislaus rivers in fall and early winter.

(4) Carryover storage of a portion of the dedicated yield in New Melones Reservoir as a contingency against future drought-induced reductions.

Clifton Court Forebay. Clifton Court Forebay is a 31,000 AF regulating reservoir at the intake to the California Aqueduct. Inflows to the forebay are controlled by radial gates and are generally operated during high tide to reduce approach velocities and prevent scour in adjacent channels. The forebay is operated to minimize water level fluctuation in the intake by taking water in through the gates at high tide and closing the gates at low tide. When the gates are open at high tide, inflow can be as high as 15,000 cfs for a short time, decreasing as water levels inside and outside the forebay reach equilibrium. This flow corresponds to a velocity of about two feet per second in the primary intake channel.

Tracy and Banks Fish Protection Facilities. Both of these facilities use behavioral barriers consisting of primary and secondary louvers to guide targeted fish into holding tanks before transport by truck to release sites within the Delta. The louvers are operated to achieve water approach velocities specified in SWRCB D-1485 for striped bass of about one foot per second, and for winter-run salmon of about three feet per second. Channel velocity criteria are a function of bypass ratios through the facility. Hauling trucks used to transport fish to release sites contain an eight parts per thousand (ppt) salt solution to reduce stress. The SWP maintains two permanent release site facilities: at Horseshoe Bend on the Sacramento River, and on Sherman Island at Curtis Landing on the San Joaquin River. The CVP uses two release sites: one on the Sacramento River near Horseshoe Bend, and the other on the San Joaquin River immediately upstream of the Antioch Bridge.

The COA between Reclamation and DWR became effective in November 1986. The agreement defines the rights and responsibilities of the CVP and SWP regarding Sacramento Valley and Delta water needs, including water required under SWRCB D-1485. The CVP and SWP are obligated to ensure that water is available for specific uses identified by the agreement. When water must be withdrawn from storage to meet Sacramento Valley and Delta needs, 75 percent of the responsibility is borne by the CVP and 25 percent by the SWP. The agreement also provides that, when unstored water is available for export, 55 percent of the sum of CVP and SWP stored water and the unstored export water, is allocated to the CVP and 45 percent is allocated to the SWP.

Some of the current operational restrictions imposed by NMFS and Service biological opinions are not addressed by the COA. Specifically, the agreement does not address sharing of responsibilities for meeting either the QWEST standard or the take limitations at the export pumping facilities. As a result, in 1993, the CVP and SWP were not operated in strict accordance with the COA. Instead, Reclamation and DWR by mutual agreement apportioned the available water supply and responsibility for meeting Delta standards between

the two projects.

Delta Cross Channel. Reclamation operates the Delta Cross Channel to augment the transfer of water from the Sacramento River to the southern Delta and the export facilities at the Banks and Tracy pumping plants (Figure 2a). Flows into the Delta Cross Channel from the Sacramento River are controlled by two 60-foot by 30-foot radial gates. In accordance with SWRCB D-1485, the gates are closed to avoid diverting salmon whenever the daily Delta Outflow Index (DOI) exceeds 12,000 cfs between January 1 and April 15. DOI is defined as the flow of water from the Delta past Chipps Island to San Francisco Bay. From April 16 through May 31, at the request of DFG the gates may be closed to avoid diverting striped bass when the DOI exceeds 12,000 cfs. According to SWRCB D-1485, Reclamation is not required to close the gates for more than two out of four consecutive days or for more than 20 total days. However, during several years, with concurrence of DFG, Reclamation kept the gates closed for most of the April 16 to May 31 period.

To reduce scour in the channels on the downstream side of the gate, and to reduce potential flood flows that might occur from diverting water from the Sacramento River through the Mokelumne River system, the gates are also closed when flows in the Sacramento River, at Sacramento, exceed 25,000 cfs. The gates also are operated occasionally to regulate flow in the Sacramento River to help meet the SWRCB D-1485 salinity standard at Emmaton. Closing the gates increases flow downstream in the Sacramento River, helps meet the SWRCB D-1485 standard, and reduces flow in the lower San Joaquin River. When the gates are closed and there is no additional inflow, the net flow of the western San Joaquin River can reverse direction, and salinity in the central and southern Delta can increase. To avoid this effect, the Delta Cross Channel gates are closed for only a day or two at a time to help meet the salinity standard at Emmaton.

The reasonable and prudent alternatives in the February 12, 1993, NMFS biological opinion for winter-run chinook salmon require closure of the Delta Cross Channel gates from February 1 through April 30 to avoid diversions of downstream-migrating juvenile salmon. Also, from October 1 through January 31, the gates must be operated to minimize diversion of juvenile winter-run chinook salmon when monitoring indicates their presence in the lower Sacramento River.

Suisun Marsh Salinity Control Structure. The SMSCS is about two miles northwest of the eastern end of Montezuma Slough, near Collinsville. The SMSCS spans Montezuma Slough, a width of 465 feet. In addition to permanent barriers adjacent to each levee, the structure consists of the following components (from east to west): (1) a flashboard module, which provides a 66-foot wide maintenance channel through the structure (the flashboards can be removed if emergency work is required downstream of the gates, but removal requires a large, barge-mounted crane); (2) a radial gate module, 159 feet across, containing three radial gates, each 36 feet wide; and (3) a boat-lock module, 20 feet across, which is operated when the flashboards are in place.

An acoustic velocity meter is located about 300 feet upstream (south) of the gates to measure water velocity in Montezuma Slough. Water level recorders on both sides of the structure allow operators to determine the difference in water level above and below the gates. The three radial gates open and close automatically, using the water level and velocity data.

Operation of the SMSCS restricts the upstream flow of salty water from Suisun Bay during flood tides while allowing the normal flow of freshwater from the Sacramento River during ebb tides. This action helps to meet SWRCB D-1485 water quality standards in marsh channels during below-normal, dry, and critical water years and during drier periods of other water-year types.

During full operation, the gates open and close twice each tidal day. Flows past the gates vary from no flow when the gates are closed to several thousand cfs with all three gates open; the net flow through the gates is about 1,800 cfs when averaged over one tidal day. Typically in summer, when the gates are not operating and the flashboards are removed, the natural net flow in Montezuma Slough is low, and often in the upstream direction from Grizzly Bay toward Collinsville.

In spring 1992, the NMFS biological opinion for winter-run chinook salmon significantly changed operation of the SMSCS from what previously occurred in critically dry years. The gates were closed from March 1 through March 27, with full gate operations beginning March 27. Individual landowners along Montezuma Slough agreed not to divert water through their unscreened diversions until May 1 so that full gate operations might occur.

North Bay Aqueduct Intake at Barker Slough. The SWP uses the NBA intake at Barker Slough to meet project entitlements in Napa and Solano counties (Figure 2a). Ultimate scheduled deliveries are expected to be about 67,000 AF annually. Maximum pumping capacity is about 175 cfs (pipeline capacity). Daily pumping rates have ranged between 0 and 90 cfs. Average annual pumping rate is 35 cfs. Water use in the NBA service area is increasing as the human population grows in Napa and Solano counties. Current demands result in pumping less than 65 cfs until April.

The Barker Slough intake has a positive barrier fish screen consisting of a series of flat, stainless steel, wedge-wire panels with a slot width of 3/32 inch designed to exclude fish 25 mm or larger from being diverted and an approach velocity of 0.5 feet per second. The screens are routinely cleaned to prevent head loss across the screen face, which would result in increased approach velocities.

Roaring River Distribution System. The Roaring River diversion and distribution system intake has a 40-acre intake pond, constructed west of the new intake culverts, that supplies water to Roaring River Slough. Flows through the culverts into the pond are controlled by motorized slide gates on the Montezuma Slough side and flap gates on the pond side. The motorized gates are adjusted depending on tide levels, diversions from Roaring River

Slough, and the season. A manually-operated flap gate that allows drainage back into Montezuma Slough for flood protection is located at the confluence with Roaring River Slough. DWR owns and operates this drain gate to ensure that the Roaring River levees are not compromised during extremely high tides.

Water is diverted into the Roaring River intake pond on high tides to raise the water surface elevation in Roaring River Slough above the adjacent marshlands. Wetlands south and north of Roaring River Slough receive water from the slough as needed. The pond is used to supplement the water supply in Roaring River Slough.

The intake to Roaring River Slough is screened to prevent entrainment of fish larger than about 25 mm. DWR designed and installed the screens using DFG criteria. Reclamation and DWR provide routine screen maintenance. The screen is a stationary, vertical screen constructed of continuous slot, stainless steel wedge wire. All screens have 3/32-inch slot openings with a design approach velocity of 0.5 foot per second. Flow through the fish screen is controlled by motorized slide gates on each culvert.

South Delta Temporary Barriers. The existing South Delta Temporary Barriers Project consists of installation and removal of temporary rock barriers at the following locations: (1) Middle River near Victoria Canal, about 0.5 miles south of the confluence of Middle River, Trapper Slough, and North Canal; (2) Old River near Tracy, about 0.5 miles east of the Delta-Mendota Canal intake; (3) the head of Old River near San Joaquin River, about 0.1 miles west of the confluence of the two rivers. The barriers on Middle and Old rivers near Tracy are tidal control facilities designed to improve water quality for irrigation and increase water levels in south Delta channels during irrigation season. Installation of these barriers is permitted only if the barrier at the head of Old River is in place. The barrier at the head of Old River is designed to improve conditions in the San Joaquin River during the migration of fall-run chinook salmon. If the temporary barriers accomplish their purpose and have minimal negative environmental impacts, DWR proposes to replace them with permanent structures (e.g., radial gates), that would be operated seasonally. Installation of the barrier at the head of Old River during the fall is permitted by the Corps from 1968 until 1997. Until 1995, it will also be permitted to reduce the number of outmigrant smolts entering Old River and subsequently exposed to the CVP and SWP intakes. In 1993, the barriers on the Middle River and the Old River near Tracy were permitted to be in place between June 1 and September 30 on an annual basis until 1995. DWR will submit a request to the Corps to permit installation of the barriers according to the original schedule presented in Figure 23 of DWR and Reclamation (1993).

Contra Costa Canal. The Contra Costa Canal, owned by Reclamation and operated by CCWD, originates at Rock Slough, about four miles southeast of Oakley. Water for irrigation, municipal, and industrial uses is lifted 127 feet by a series of four pumping plants. The 47.7-mile canal terminates in Martinez Reservoir. Two short canals, Clayton and Ygnacio, are integrated into the

system. The initial diversion capacity of 350 cfs gradually decreases to 22 cfs at the terminus. Historically, pumping has ranged from about 50 to 250 cfs, and varies seasonally.

Service's 1993 Biological Opinion (Service 1993e). The 1993 biological opinion on the effects of CVP and SWP operations on the delta smelt established part of the baseline conditions from May 26, 1993, to February 15, 1994.

Mitigation measures proposed by Reclamation and DWR in Service (1993e) that were implemented to benefit the delta smelt, included: (1) no reverse flow in the western Delta, based on the 14-day running average of the QWEST index, from May 1 through June 30; (2) the flow in the western Delta shall exceed negative 1,000 cfs from July 1 through July 31; and negative 2,000 cfs from December 1 through January 31; (3) springtime pulse flows were required from both the Sacramento and San Joaquin rivers to help transport larval delta smelt through the Delta and into Suisun Bay; (4) for Sacramento River at Freeport, Rio Vista, and Chipps Island, minimum daily flows were set for March through August and December through February 15; (5) CVP and SWP reduced combined Delta exports at Tracy and Banks to a daily average of not more than 1,500 cfs during the period April 26 through May 16, or coincident with the arrival of the San Joaquin pulse flows in the Delta; (6) for combined Delta pumping at Tracy, Banks and Contra Costa, the 14-day running average export rate was set from April through July; and (7) the CVP and SWP were operated to maintain the salinity regime in eastern Suisun Bay to provide a 14-day running average electro-conductivity of 3 mmhos per centimeter at Mallard Slough from May 1 to June 30.

In 1993, Reclamation and DWR had agreed to study and monitor effects of operations and facilities on the delta smelt. The Interagency Ecological Study Program (now the Interagency Ecological Program or IEP) was also conducting monitoring and studies in the Delta that addressed most of the effects of the 1993 proposed CVP and SWP operations which included the winter-run chinook salmon biological opinion modifications. The following studies and monitoring were done by Reclamation and DWR as part of 1993 CVP and SWP proposed operations: 1) Information was obtained on the average daily position of the 2 ppt isohaline (as measured one meter off the bottom), the average net daily Delta outflow of the Sacramento River at Chipps Island, and the average daily QWEST value for the San Joaquin River; and surveys were conducted for adult and larval delta smelt in the vicinity of the 2 ppt isohaline; (2) studies were done to determine more effective fish salvage procedures at the CVP and SWP fish protection facilities; (3) the past operation of SMSCS was analyzed; (4) studies were continued to better quantify the population of delta smelt and determine the location of spawning areas; and (5) studies were conducted to address ways of minimizing diversion of adult and larval fish within the Delta, including screening requirements.

The reasonable and prudent measures in the May 26, 1993, biological opinion provided: (1) improved salvage operations at Tracy and Skinner Fish Protection Facilities; (2) decreased pumping at the Barker Slough intake; (3) decreased

pumping at the Tracy and Banks pumping plants and use of a 400-fish take limit that was modified on June 30, 1993, to a 14-day running average of 400 delta smelt; and (4) QWEST requirements that reduced delta smelt juvenile and adult losses.

Service's 1994 Biological Opinion (Service 1994d). This jeopardy opinion imposed constraints on operations of the projects from February 4, 1994, through February 15, 1995. The reasonable and prudent alternative required: (1) habitat and transport flows which consisted of placement of the 2 ppt isohaline downstream of Collinsville, and Delta outflows with Sacramento and San Joaquin components; (2) San Joaquin River flows for 30 days triggered by the presence of delta smelt; (3) actions to deal with the presence of delta smelt upstream of the confluence in July-August; and (4) investigations of the effects of the SMSCS. The reasonable and prudent measures to minimize the effects of incidental take of delta smelt included: (1) improve salvage operations at the Tracy and Skinner Fish Facilities; (2) minimize take at the Tracy and Skinner Fish Facilities; (3) minimize take at the NBA diversion on Barker Slough; (4) minimize take at the Roaring River diversion in Montezuma Slough; and (5) minimize take at CCWD Rock and Mallard slough diversions. The terms and conditions implementing these reasonable and prudent measures included: (1) addition of a new, fully functional release site near the Rio Vista Bridge; (2) a monthly take limit at the CVP and SWP pumping plants; (3) limited diversions at the Barker Slough intake; (4) a change in approach velocity at the Roaring River diversion; and (5) minimization of delta smelt take at the unscreened Rock and Mallard slough diversions. In addition, within the project description for the 1994 biological opinion, the protective measures for winter-run chinook salmon through QWEST requirements also provided biological benefits to delta smelt. In fact, the foundation of the delta smelt biological opinion was built on NMFS's February 4, 1993, winter-run chinook salmon biological opinion.

SPECIES ACCOUNT/ENVIRONMENTAL BASELINE

Species Account

Delta smelt. Please refer to Service (1993a, 1993e, 1994d) and DWR and Reclamation (1994) for additional information on the biology and ecology of the delta smelt. Delta smelt are a slender-bodied fish with a steely blue sheen on the sides and seem almost translucent (Moyle 1976). The delta smelt, which has a lifespan of one year, has an average length of 60 to 70 mm (about 2 to 3 inches) and are endemic to Suisun Bay upstream of San Francisco Bay through the Delta in Contra Costa, Sacramento, San Joaquin, and Solano counties, California. Historically, the delta smelt is thought to have occurred from Suisun Bay upstream to at least the city of Sacramento on the Sacramento River and Mossdale on the San Joaquin River (Moyle *et al.* 1992, Sweetnam and Stevens 1993). The delta smelt is an euryhaline species (tolerant of a wide salinity range) that spawns in fresh water and has been collected from estuarine waters up to 14 ppt salinity (Moyle *et al.* 1992). For a large part of its annual life span, this species is associated with the

freshwater edge of the mixing zone (saltwater-freshwater interface), where the salinity is approximately 2 ppt (Ganssle 1966, Moyle *et al.* 1992, Sweetnam and Stevens 1993).

The delta smelt is adapted to living in the highly productive Sacramento-San Joaquin river estuary where salinity varies spatially and temporally according to tidal cycles and the amount of freshwater inflow. Despite this tremendously variable environment, the historical Estuary probably offered relatively constant suitable habitat conditions for delta smelt, because they could move upstream or downstream with the mixing zone (Moyle, pers. comm., 1993). The final rule to list the delta smelt as threatened, describes in detail the factors that have contributed to this species' decline (Service 1993a).

Shortly before spawning, adult delta smelt migrate upstream from the brackish-water habitat associated with the mixing zone to disperse widely into river channels and tidally-influenced backwater sloughs (Radtke 1966, Moyle 1976, Wang 1991). Migrating adults with nearly mature eggs were taken at the CVP's Tracy Pumping Plant from late December 1990 to April 1991 (Wang 1991).

Delta smelt spawn in shallow, fresh, or slightly brackish water upstream of the mixing zone (Wang 1991). Most spawning occurs in tidally-influenced backwater sloughs and channel edgewaters (Moyle 1976; Wang 1986, 1991; Moyle *et al.* 1992). Although delta smelt spawning behavior has not been observed in the wild (Moyle *et al.* 1992), the adhesive, demersal eggs are thought to attach to substrates such as cattails, tules, tree roots, and submerged branches (Moyle 1976, Wang 1991).

Spawning locations appear to vary widely from year to year (DWR and Reclamation 1993). Sampling of larval delta smelt in the Delta suggests spawning has occurred in the Sacramento River, Barker Slough, Lindsey Slough, Cache Slough, Georgiana Slough, Prospect Slough, Beaver Slough, Hog Slough, Sycamore Slough, in the San Joaquin River off Bradford Island including Fisherman's Cut, False River along the shore zone of Frank's Tract and Webb's Tract, and possibly other areas (Dale Sweetnam, DFG, pers. comm.; Wang 1991). Delta smelt also may spawn north of Suisun Bay in Montezuma and Suisun sloughs and their tributaries (Lesa Meng, Service, pers. comm.; Sweetnam, DFG, pers. comm.).

The spawning season varies from year to year and may occur from late winter (December) to early summer (July). Moyle (1976) collected gravid adults from December to April, although ripe delta smelt were most common in February and March. In 1989 and 1990, Wang (1991) estimated that spawning had taken place from mid-February to late June or early July, with peak spawning occurring in late April and early May. A recent study of delta smelt eggs and larvae (Wang and Brown 1994 as cited in DWR and Reclamation 1994) confirmed that spawning may occur from February through June, with a peak in April and May. Spawning has been reported to occur at about 7 to 15° C. Initial results from a University of California at Davis (UCD) study (Cech and Swanson 1993 as cited

in DWR and Reclamation 1994) indicate that although delta smelt tolerate a wide range of temperatures (<8° C to >25° C), warmer water temperatures restrict their distribution more than colder water temperatures.

Laboratory observations indicate that delta smelt are broadcast spawners that spawn in a current, usually at night, distributing their eggs over a local area (Lindberg 1992 and Mager 1993 as cited in DWR and Reclamation 1994). The eggs form an adhesive foot that appears to stick to most surfaces. Eggs attach singly to the substrate, and few eggs were found on vertical plants or the sides of a culture tank (Lindberg 1993 as cited in DWR and Reclamation 1994).

Delta smelt eggs hatched in 9 to 14 days at temperatures from 13 to 16° C during laboratory observations in 1992 (Mager 1992 as cited in Sweetnam and Stevens 1993). In this study, larvae began feeding on phytoplankton on day four, rotifers on day six, and *Artemia* nauplii at day 14. In laboratory studies, yolk-sac fry were found to be positively phototaxic, swimming to the lightest corner of the incubator, and negatively buoyant, actively swimming to the surface. The post-yolk-sac fry were more evenly distributed throughout the water column (Lindberg 1992 as cited in DWR and Reclamation 1994). After hatching, larvae and juveniles move downstream toward the mixing zone where they are retained by the vertical circulation of fresh and salt waters (Stevens *et al.* 1990). The pelagic larvae and juveniles feed on zooplankton. When the mixing zone is located in Suisun Bay where there is extensive shallow-water habitat within the euphotic zone (depths less than four meters), high densities of phytoplankton and zooplankton may accumulate (Arthur and Ball 1978, 1979, 1980). In general, estuaries are among the most productive ecosystems in the world (Goldman and Horne 1993). Estuarine environments produce an abundance of fish as a result of plentiful food and shallow, productive habitat.

When the 2 ppt isohaline is contained within Suisun Bay, young delta smelt are dispersed more widely throughout a large expanse of shallow-water and marsh habitat than when the 2 ppt isohaline is upstream in the deeper Delta channels. Dispersion in areas downstream from Collinsville reduces their susceptibility to entrainment in Delta water diversions and distributes juvenile delta smelt among the extensive, protective, and highly productive shoal regions of Suisun Bay. In contrast, when located upstream, the mixing zone becomes confined in the deeper river channels, that are smaller in total surface area, contain fewer shoal areas, and are less productive.

Proposed Delta Smelt Critical Habitat

In determining which areas to designate as critical habitat, the Service considers those physical and biological features that are essential to a species' conservation and that may require special management considerations or protection (50 CFR 424.12(b)). The Service is required to list the known primary constituent elements together with the critical habitat description. Such physical and biological features include, but are not limited to, the

following:

(1) space for individual and population growth, and for normal behavior;

(2) food, water, air, light, minerals, or other nutritional or physiological requirements;

(3) cover or shelter;

(4) sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal; and

(5) generally, habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species.

In proposing critical habitat, the Service identified the following primary constituent elements essential to the conservation of the delta smelt: physical habitat, water, river flow, and salinity concentrations required to maintain delta smelt habitat for spawning, larval and juvenile transport, rearing, and adult migration. Proposed critical habitat for delta smelt is contained within Contra Costa, Sacramento, San Joaquin, Solano, and Yolo counties (Figure 2b).

Spawning habitat. Specific areas that have been identified as important delta smelt spawning habitat include Barker, Lindsey, Cache, Prospect, Georgiana, Beaver, Hog, and Sycamore sloughs and the Sacramento River in the Delta, and tributaries of northern Suisun Bay (Figure 2b). The spawning season varies from year to year and may start as early as December and extend until July.

Larval and juvenile transport. Adequate river flow is necessary to transport larvae from upstream spawning areas to rearing habitat in Suisun Bay and to ensure that rearing habitat is maintained in Suisun Bay (Figure 2b). To ensure this, the 2 ppt isohaline must be located westward of the Sacramento River/San Joaquin River confluence during the period when larvae or juveniles are being transported, according to historical salinity conditions (Figure 2c). Habitat conditions suitable for transport of larvae and juveniles may be required as early as February 1 and as late as August 31.

Rearing habitat. An area extending eastward from Carquinez Straits, including Suisun, Grizzly, and Honker bays, Montezuma Slough and its tributary sloughs, up the Sacramento River to its confluence with Three Mile Slough, and south along the San Joaquin River including Big Break, defines the specific geographic area critical to the maintenance of suitable rearing habitat (Figure 2b). Three Mile Slough represents the approximate location of the most upstream extent of tidal excursion when historical salinity conditions are implemented. Protection of rearing habitat conditions may be required from the beginning of February to the end of August.

Adult migration. Adequate flow and suitable water quality must be maintained to attract migrating adults in the Sacramento and San Joaquin river channels and their associated tributaries, including Cache and Montezuma sloughs and their tributaries (Figure 2b). These areas also must be protected from physical disturbance and flow disruption during migratory periods.

The Service's 1993 and 1994 biological opinions provided for larval and juvenile transport flows, rearing habitat, and protection from entrainment for upstream migrating adults (Service 1993e, 1994d).

Sacramento Splittail

The Sacramento splittail is a large cyprinid that can reach greater than 12 inches in length (Moyle 1976). Adults are characterized by an elongated body, distinct nuchal hump, and a small blunt head with barbels usually present at the corners of the slightly subterminal mouth. This species can be distinguished from other minnows in the Central Valley of California by the enlarged dorsal lobe of the caudal fin. Sacramento splittail are a dull, silvery-gold on the sides and olive-grey dorsally. During the spawning season, the pectoral, pelvic and caudal fins are tinged with an orange-red color. Males develop small white nuptial tubercles on the head.

Sacramento splittail are endemic to California's Central Valley where they were once widely distributed in lakes and rivers (Moyle 1976). Historically, Sacramento splittail were found as far north as Redding on the Sacramento River and as far south as the site of Friant Dam on the San Joaquin River (Rutter 1908). Rutter (1908) also found Sacramento splittail as far upstream as the current Oroville Dam site on the Feather River and Folsom Dam site on the American River. Anglers in Sacramento reported catches of 50 or more Sacramento splittail per day prior to damming of these rivers (Caywood 1974). Sacramento splittail were common in San Pablo Bay and Carquinez Strait following high winter flows up until about 1985 (Messersmith 1966, Moyle 1976, and Wang 1986 as cited in DWR and Reclamation 1994).

In recent times, dams and diversions have increasingly prevented upstream access to large rivers and the species is restricted to a small portion of its former range (Moyle and Yoshiyama 1989). Sacramento splittail enter the lower reaches of the Feather (Jones and Stokes 1993) and American rivers (Charles Hanson, State Water Contractors, in litt., 1993) on occasion, but the species is now largely confined to the Delta, Suisun Bay, and Suisun Marsh (Service 1994b). Stream surveys in the San Joaquin Valley reported observations of Sacramento splittail in the San Joaquin River below the mouth of the Merced River and upstream of the confluence of the Tuolumne River (Saiki 1984 as cited in DWR and Reclamation 1994).

Sacramento splittail are long-lived, frequently reaching five to seven years of age. Generally, females are highly fecund, producing over 100,000 eggs each year (Daniels and Moyle 1983 as cited in DWR and Reclamation 1994).

Populations fluctuate annually depending on spawning success. Spawning success is highly correlated with freshwater outflow and the availability of shallow-water habitat with submersed, aquatic vegetation (Daniels and Moyle 1983). Sacramento splittail usually reach sexual maturity by the end of their second year at a size of 180 to 200 mm. There is some variability in the reproductive period since older fish reproduce before younger individuals (Caywood 1974). The largest recorded Sacramento splittail have measured between 380 and 400 mm (Caywood 1974, Daniels and Moyle 1983 as cited in DWR and Reclamation 1994). Adults migrate into fresh water in late fall and early winter prior to spawning. The onset of spawning is associated with rising temperature, lengthening photoperiod, seasonal runoff, and possibly endogenous factors from the months of March through May, although there are records of spawning from late January to early July (Wang 1986). Spawning occurs in water temperatures from 9° to 20° C over flooded vegetation in tidal freshwater and euryhaline habitats of estuarine marshes and sloughs and slow-moving reaches of large rivers. The eggs are adhesive or become adhesive soon after contacting water (Caywood 1974, and Bailey, University of California at Davis, pers. comm. 1994 as cited in DWR and Reclamation 1994). Larvae remain in shallow, weedy areas close to spawning sites and move into deeper water as they mature (Wang 1986).

Sacramento splittail are benthic foragers that feed on opossum shrimp, although detrital material makes up a large percentage of their stomach contents (Daniels and Moyle 1983). Earthworms, clams, insect larvae, and other invertebrates are also found in the diet. Predators include striped bass and other piscivores. Sacramento splittail are sometimes used as bait for striped bass.

Sacramento splittail can tolerate salinities as high as 10 to 18 ppt (Moyle 1976, Moyle and Yoshiyama 1992). Sacramento splittail are found throughout the Delta (Turner 1966), Suisun Bay, and Suisun and Napa marshes. They migrate upstream from brackish areas to spawn in freshwater. Because they require flooded vegetation for spawning and rearing, Sacramento splittail are frequently found in areas subject to flooding.

The 1985 to 1992 decline in Sacramento splittail abundance (Figure 3) is concurrent with hydrologic changes to the Estuary. These changes include increases in water diversions during the spawning period from January through July. Diversions, dams and reduced outflow, coupled with severe drought years, introduced aquatic species, and loss of wetlands and shallow-water habitat (DFG 1992) have reduced the species' capacity to reverse its decline.

Environmental Baseline

Until February 15, 1995, the existing environmental baseline will include CVP and SWP operations as modified by the requirements of SWRCB D-1485, the February 12, 1993, winter-run chinook salmon biological opinion issued by the NMFS, and the February 4, 1994, delta smelt biological opinion issued by the Service (1994d). The Service's 1993 opinion addressed effects of the CVP and

SWP from May 26, 1993, to February 15, 1994, and was superseded by the 1994 biological opinion which addresses the period from February 4, 1994, to February 15, 1995. Included in the 1994 CVP and SWP project operations were reasonable and prudent alternatives to benefit the delta smelt. Reclamation and DWR (1994) have not included these reasonable and prudent alternatives in the long-term CVP and SWP project operations. Therefore, after February 15, 1995, the environmental baseline for the delta smelt will consist of SWRCB D-1485 conditions as modified only by requirements of NMFS's 1993 winter-run chinook salmon biological opinion; returning the environmental baseline to the pre-May 26, 1993 condition. For the reasons described below, these baseline conditions likely will perpetuate the short-term population decline of the delta smelt and substantially reduce the likelihood of its long-term recovery.

The delta smelt is adapted to living in the highly productive Estuary where salinity varies spatially and temporally according to tidal cycles and the amount of freshwater inflow. Despite this tremendously variable environment, the historical Estuary probably offered relatively consistent spring transport flows that moved delta smelt juveniles and larvae downstream to the mixing zone (Peter Moyle, UCD, pers. comm.). Since the 1850's, however, the amount and extent of suitable habitat for the delta smelt has declined dramatically. The advent in 1853, of hydraulic mining in the Sacramento and San Joaquin rivers, led to increased siltation and alteration of the circulation patterns of the Estuary (Nichols *et al.* 1986, Monroe and Kelly 1992). The reclamation of Merritt Island for agricultural purposes, in the same year, marked the beginning of the present-day cumulative loss of 94 percent of the Estuary's tidal marshes (Nichols *et al.* 1986, Monroe and Kelly 1992).

In addition to the degradation and loss of estuarine habitat, the delta smelt has been increasingly subject to entrainment, upstream or reverse flows of waters in the Delta and San Joaquin River, and constriction of low salinity habitat to deep-water river channels of the interior Delta (Moyle *et al.* 1992). These adverse conditions are primarily a result of drought and the steadily increasing proportion of river flow being diverted from the Delta by the CVP and SWP (Monroe and Kelly 1992). Figure 4a shows the relationship between the portion of the delta smelt population west of the Delta as sampled in the summer townet survey and the natural logarithm of Delta outflow from 1959 to 1988 (DWR and Reclamation 1994). This relationship indicates that the summer townet index increased dramatically when outflow was between 34,000 and 48,000 cfs placing X2 between Chipps and Roe islands. Placement of X2 at Chipps and Roe islands would duplicate these favorable conditions.

Operations of the CVP began in 1940. The SWP began delivering water in 1968. However, the proportion of fresh water being diverted has increased since 1983, and has remained at extremely high levels ever since (Moyle *et al.* 1992). The high proportion of fresh water exported has exacerbated the already harsh environmental conditions experienced by the delta smelt during the last six drought years. The relationship between expanded salvage of juvenile delta smelt at the Skinner Fish Facility and total Delta outflow is shown in Figure 4b (DWR and Reclamation 1994). This relationship indicates

that if delta smelt have been moved downstream past the confluence by outflows, that salvage decreases. This relationship has broken down in recent years (S. Ford, DWR, pers. comm.), possibly due to Delta Cross Channel gate closures imposed by the NMFS biological opinion. As an example of delta smelt response to favorable placement of X2, low salinity habitat was pushed downstream of Roe Island at the beginning of 1993 due to above normal precipitation and resulting outflows plus implementation of measures contained in the delta smelt 1993 biological opinion. By late 1993, however, low salinity habitat moved back upstream as inflow decreased and water exports increased. The fall midwater trawl index showed an increase in delta smelt abundance concurrent with the more favorable placement of low salinity habitat in early 1993. In May and June 1993, salvage of delta smelt at the Skinner Fish Facility was 15,901 and 6,187 individuals, respectively. Therefore, placement of X2 at Chipps and Roe islands as evidenced by 1993 hydrology is important in maintaining delta smelt distribution and abundance.

The results of seven surveys (Figure 5) currently done by the IESP (now IEP) corroborate the dramatic decline in delta smelt attributable to baseline conditions. Existing baseline conditions do not provide sufficient Delta outflows from February 1 through June 30 to transport larval and juvenile delta smelt out of the "zone of influence" of the pumps, nor provide them low salinity, productive rearing habitat (Figures 4a,4b). If X2 were placed at the confluence, Chipps and Roe islands would provide delta smelt with low salinity, productive rearing habitat that would increase both smelt abundance and distribution.

The seven abundance indices used to record trends in the status of the delta smelt showed that this species was consistently at low population levels in the last ten years (Stevens *et al.* 1990) (Figure 5). These same indices also show a pronounced decline from historical levels of abundance (Stevens *et al.* 1990). The summer townet abundance index is thought to be one of the more representative indices because data have been collected over a wide geographic area (from San Pablo Bay upstream through most of the Delta) for the longest period of time (since 1959). Figure 6a shows the distribution of summer townet sampling sites. The summer townet abundance index measures the abundance and distribution of juvenile delta smelt and provides data on the recruitment potential of the species. Except for three years since 1983 (1986, 1993, and 1994), this index has remained at consistently lower levels than experienced previously (Figure 6b). As indicated in Figure 2c, these consistently lower levels correlate with the 1983 to 1992 mean location of X2 upstream of the confluence, Chipps and Roe islands.

The second longest running survey (since 1967), the fall midwater trawl survey, measures the abundance and distribution of late juveniles and adult delta smelt in a large geographic area (San Pablo Bay upstream to Rio Vista on the Sacramento River and Stockton on the San Joaquin River, Figure 7a)(Stevens *et al.* 1990). The fall midwater trawl provides an indication of the abundance of the adult population. Figure 7b shows that until recently, except for 1991, this index has declined irregularly over the past 20 years. Since 1983,

the delta smelt population has exhibited more low fall midwater trawl abundance indices for more consecutive years, than previously recorded. September and October 1994 values of 62.7 and 13.5, respectively, are a continuation of this trend. Losses of delta smelt at the CVP and SWP pumps shown in Figure 8 and losses due to other CVP and SWP operations are thought to be part of the reason for these declines (Figures 4a,4b). Minimal placement of X2 at the confluence maintains delta smelt downstream of the influence of the pumps for 50 percent of the time with tidal influence.

Analysis of salinity preferences using fall midwater trawl data indicate that delta smelt distribution peaks upstream of the mixing zone (Obrebski 1993 as cited in DWR and Reclamation 1994). Delta smelt distribution is fairly broad, particularly in years when abundance levels are high (DWR and Reclamation 1994). In late 1993 extending to July of 1994, delta smelt were found in Suisun Bay, downstream of X2. Samples from Suisun Bay showing high concentrations of *Eurytemera affinis* suggest that food availability may also influence smelt distribution. Herbold (1994 as cited in DWR and Reclamation 1994), was able to demonstrate a correlation between abundance and X2 position (Figure 9). This correlation showed maximum increases in abundance occurring when X2 was between Roe Island and Middle Ground Shoals. Placement of X2 at Roe Island would promote these increases in abundance with tidal effects moving X2 upstream to Chipps Island 50 percent of the time and downstream into Grizzley Bay 50 percent of the time. DWR and Reclamation (1994) concluded that the location of X2 may be a "necessary but not sufficient condition" for a high abundance index, but that other factors determine whether or not that opportunity is realized. Entrainment of upstream migrating adults at the Federal and State pumps, San Joaquin River transport flows, and other adverse environmental effects also affect the abundance index.

Export Pumping, Reverse Flows, and Entrainment. Existing baseline conditions do not provide the necessary positive riverine flows and estuarine outflows to transport delta smelt larvae downstream to suitable rearing habitat outside the influence of the Federal and State pumping plants. When the total Delta diversion rates are high, the lower San Joaquin, Old, and Middle rivers, and other Delta channels, have a net upstream (*i.e.*, reverse or negative) flow. Out-migrating larval and juvenile fish of many species, including delta smelt, become entrained in these flows and are displaced upstream into the south Delta. The Federal Tracy Pumping Plant can export water at rates up to 4,600 cfs. The State operated Banks Pumping Plant generally exports water at rates up to 6,400 cfs. At times, an additional 3,900 cfs of San Joaquin River flow can be diverted through the use of four newly installed pumps. Pumping from Barker Slough, a delta smelt spawning area, through the North Bay Aqueduct has averaged at least 36,000 AF in 1990 and 1991 (with flows of about 50 cfs). Pumping from Rock Slough into the Contra Costa Canal adds another 250 cfs diversion. In addition, local private water right holders divert 3,000 to 4,000 cfs during the peak irrigation season from about 1,800 diversions throughout the Delta. Fish are lost at these diversions, at CVP and SWP diversions (Figure 8), and also as a result of predation by striped bass and other predators.

In recent years, the number of days of reverse San Joaquin River flow which enhances transport of fish to the pumps have increased, particularly during the January to July spawning months for delta smelt (Moyle *et al.* 1992). However, DWR and Reclamation (1994) did not find a significant statistical relationship between reverse flow and various measurements of delta smelt abundance. Nonetheless, all size classes of delta smelt are lost from the Estuary when they are entrained at the water project intakes in the south Delta (Sweetnam and Stevens 1993). In January 1993, during upstream spawning migration, 3,086 delta smelt adults were salvaged at the Skinner Fish Facility. Average monthly numbers of delta smelt adults and juveniles salvaged at the Skinner Fish Facility from 1980 to 1992, are as follows:

January (2,354 individuals), February (1,422), March (765), April (676), May (1,413), June (7,884), July (4,309), August (1,041), September (111), October (85), November (142), and December (943).

Salvaged delta smelt probably do not survive because of stress due to handling and trucking (Sweetnam and Stevens 1993). To estimate losses due to screen effects, salvage numbers would have to be multiplied by a factor that varies with length of the fish (as delta smelt increase in length, screen efficiency increases). Other sources of losses that would need to be accounted for in a multiplying factor are predation and handling losses. Currently, preliminary delta smelt morphometric and swimming efficiency information and some behavioral information are available (Cech, UCD, pers. comm.) but a final determination on appropriate screen mesh size, approach velocity, and response to louvering has not been made. There are also no data on predation rates on delta smelt or any closely related species. None of the data discussed above reflect losses of larvae, which are too small to be screened or salvaged.

Table 1 shows monthly salvage figures (expressed in numbers of individuals) for delta smelt at CVP and SWP fish facilities since the issuance of the 1994 delta smelt biological opinion.

Table 1. Expanded numbers for delta smelt salvage at CVP and SWP fish facilities from February through August, 1994.

MONTH	CVP	SWP
February	120	54
March	108	61
April	728	217
May	16,776	15,361
June	3,720	5,141
July	12	1,592
August	0	0
Total	21,464	22,426
Combined Total	43,890	

Salvage data from the CVP and SWP show that dry year effects are generally greater than wet year effects (DWR and Reclamation 1994). A shift in delta smelt distribution toward the export facilities in dry years is thought to be responsible for this trend.

February 4, 1994, Biological Opinion on Effects of CVP and SWP on Delta Smelt. The 1994 delta smelt biological opinion established part of the baseline conditions for this consultation to include the period from February 4, 1994, to February 15, 1995. (See Service (1994d) for information concerning the reasonable and prudent alternative and reasonable and prudent measures contained within that jeopardy opinion.)

The results of monitoring activities indicate that implementation of the reasonable and prudent alternative may have moved some delta smelt downstream of the Delta during the February through May period, and that 6,800 cfs flows were helpful in maintaining delta smelt in a downstream location (DWR and Reclamation 1994). Outflow averaged more than 12,000 cfs in March and more than 7,000 cfs in April and May. However, delta smelt did not migrate west until June, after outflow had dropped to about 4,000 cfs. The majority of the fish that migrated in June probably were responding to additional cues.

The combined 14-day running average take limit of 755 for CVP and SWP salvage facilities was exceeded on the following dates: May 23--787; May 24--809; May 26--861; May 27--1,128; May 28--1,187; May 29--1,335; May 30--1,433; May 31--1,410; and June 1--779. The combined salvage during this period ranged from 248 to 4,616 delta smelt with an average of 919 fish. The average combined salvage for the last 10-days of May was 1,833 fish/day.

Figure 7b shows fall midwater trawl index values of 62.7, 13.5, and 6.8 respectively, for September, October, and November of 1994. These values are similar to the September and October of 1992 values of 71.5 and 3.5 which resulted in a yearly index of 156.8. These data indicate that the 1994 fall

midwater trawl index values may be the lowest in the last 20 years.

Conclusion

As stated previously, operations agreed to in Service (1993e, 1994d) were each in effect for only one year and Reclamation and DWR have not included similar delta smelt mitigation measures in the proposed long-term operation of the CVP and SWP. Therefore, after February 15, 1995, the environmental baseline for the delta smelt will revert to SWRCB D-1485 conditions as modified by requirements of NMFS's 1993 winter-run chinook salmon biological opinion. With these conditions, the population decline of the delta smelt is likely to continue and the long-term population recovery will likely not occur.

Proposed Delta Smelt Critical Habitat

Adverse modification or destruction of critical habitat may be analyzed based on the implementation of the reasonable and prudent alternatives in the Service's May 26, 1993, or February 4, 1994, biological opinions, and NMFS's 1992 and 1993 biological opinions for winter-run.

Proposed critical habitat has been adversely affected by diversions that have shifted the position of X2 upstream. This shift has caused a decreased abundance of delta smelt (Figure 7b). Existing baseline conditions and implementation of the Service's 1993 and 1994 biological opinions provide a substantial part of the necessary positive riverine flows and estuarine outflows to transport delta smelt larvae downstream to suitable rearing habitat in Suisun Bay outside the influence of the Federal and State pumping plants. However, in order not to appreciably reduce the likelihood of recovery, additional flows may be necessary to transport and maintain delta smelt larvae and juveniles in rearing habitat between Chipps and Roe islands. This geographic location is most suitable for distribution and production of delta smelt (Figure 9).

Sacramento Splittail

Figure 3 shows the decline of the Sacramento splittail over the past 10 years using fall midwater trawl data. This decline is due to hydrologic changes in the Estuary. These changes include increases in water diversions during the spawning period of January through July. Most of the factors that caused delta smelt to decline have also caused to the decline of this species. Diversions, dams and reduced outflow, coupled with severe drought years, introduced aquatic species such as the Asiatic clam (Nichols *et al.* 1990), and loss of wetlands and shallow-water habitat (DFG 1992) appear to have perpetuated the species' decline.

Table 2 shows monthly salvage figures for Sacramento splittail at CVP and SWP fish facilities since the issuance of the 1994 delta smelt biological opinion.

Table 2. Expanded numbers for Sacramento splittail salvage at CVP and SWP fish facilities from February through August, 1994.

MONTH	CVP	SWP
February	228	55
March	196	28
April	36	0
May	132	72
June	2,088	73
July	336	18
August	0	0
Total	3,016	246
Combined Total	3,262	

Based on the environmental baseline conditions described here, and those described earlier for the delta smelt, the Service finds that the population decline of the Sacramento splittail is likely to continue and the long-term recovery of this species will likely not occur.

EFFECTS OF THE PROPOSED ACTION

Please refer to the Service (1993e, 1994d) and DWR and Reclamation (1993, 1994) for more information on the effects of the CVP and SWP on the delta smelt. The Service's 1993 biological opinion addressed effects for the period from May 26, 1993, to February 4, 1994, and the 1994 biological opinion addressed effects for the period from February 4, 1994, to February 15, 1995. Post-February 4, 1994, conditions contributed to an increase in abundance of delta smelt as indicated by the 1994 summer townet survey (Figure 6b). However, preliminary results of the 1994 fall midwater trawl survey (Figure 7b) indicate that this years' drought conditions coupled with other adverse conditions have contributed to the decline of this species. The proposed action will maintain pre-May 26, 1993, operation of the CVP and SWP that has perpetuated the decline of the delta smelt and will substantially reduce the likelihood of its long-term recovery.

NMFS Biological Opinion of February 12, 1993

The elements of the reasonable and prudent alternative from the NMFS biological opinion of February 12, 1993 which are incorporated into the proposed operations and are beneficial to delta smelt are summarized in the following list:

(1) Reclamation to use at least 90 percent probability of exceedance forecast for determining deliverable water. This is beneficial because it provides assurance that the forecast is conservative and that water is

not allocated when supplies may not be available. Thus, water needed to benefit delta smelt is not delivered to water users when uncertainty exists as to water conditions.

(2) Control of QWEST through operation of the export facilities from February 1 through April 30 such that the 14-day running average exceeds 0 cfs, and 7-day running average exceeds -1000 cfs. As stated previously, delta smelt spawn from February 1 through April 30. This QWEST requirement provides protection from entrainment at the State and Federal facilities. In addition, this requirement may contribute to outflows that help to transport larvae and juveniles to suitable rearing habitat and maintain that habitat in Suisun Bay.

(3) Control of QWEST through operation of the export facilities from November 1 through January 31 such that the 14-day running average exceeds -2,000 cfs, and 7-day running average exceeds -3,000 cfs. Delta smelt adults migrate upstream in December and January. This QWEST requirement provides some protection from entrainment at the Federal and State facilities during this interval.

Habitat and Transport Flows

Proposed operations of the CVP and SWP do not provide adequate flows to transport delta smelt away from the influence of the pumps and provide productive, low-salinity rearing habitat in Suisun Bay. Flows for these purposes are needed from February to the end of June during most years. Because delta smelt are weak swimmers as larvae and early-juveniles, they are passively transported with flows. Therefore, during the larval and early-juvenile phases, flows of sufficient magnitude and duration are needed to transport and disperse delta smelt from the Delta to the Estuary. Bruce Herbold (EPA, pers. comm., 1994) has found a positive correlation between Delta outflow and delta smelt abundance as measured by the fall midwater trawl index when the 2 ppt isohaline is between Middle Ground Shoals and Roe Island (Figure 9). These data indicate that placement of the 2 ppt isohaline downstream of Chipps Island may be beneficial to recruitment. Historical placement of the 2 ppt isohaline is shown in Figure 2c.

To ensure adult recruitment, delta smelt larvae must be transported during the months of February to the end of August from the area where they hatch to shallow, productive rearing or nursery habitat in Suisun Bay. Adequate river flow is necessary to provide this transport to Suisun Bay. Proposed operations would result in reverse flows interfering with these transport requirements, maintaining larvae upstream in deep-channel regions of low productivity, and exposing them to entrainment. The specific geographic area important for larval transport is confined to waters contained within the Delta, Suisun Bay, and Montezuma Slough and its tributaries. The specific season when habitat conditions identified above are important for successful larval transport varies from year to year depending upon when peak spawning occurs.

Maintenance of X2 between Collinsville and Chipps Island within the Estuary is necessary to provide delta smelt larvae and juveniles with a shallow, protective, food-rich environment in which to mature to adulthood. After hatching, larvae are transported downstream toward the mixing zone where they are retained by the vertical circulation of fresh and salt water (Stevens *et al.* 1990). After the first 15 days, the pelagic larvae and juveniles feed on zooplankton. When the mixing zone is located in a broad geographic area with extensive shallow-water habitat within the euphotic zone (depths less than 4 meters), high densities of phytoplankton and zooplankton are produced (Arthur and Ball 1978, 1979, 1980), and larval and juvenile fish (including delta smelt) grow rapidly (Moyle *et al.* 1992, Sweetnam and Stevens 1993). When the mixing zone is contained within Suisun Bay, young delta smelt are dispersed widely throughout a large expanse of shallow-water and marsh habitat. Dispersion in shallow regions protects delta smelt from large predators and increases the likelihood of their survival to adulthood. In contrast, when located upstream, the mixing zone becomes confined to the deep river channels which are smaller in total surface area, contain fewer shoal areas, have swifter, more turbulent water currents and lack high zooplankton productivity (Moyle *et al.* 1992).

Placement of X2 in Suisun Bay also serves to protect larval, juvenile, and adult delta smelt from entrainment in the CVP and SWP pumps as well as from agricultural diversions. The confluence of the Sacramento-San Joaquin rivers at Collinsville defines the western limits of the "zone of influence" of the pumps (Service 1993b, DWR and Reclamation 1993). However, tidal influence in this area moves delta smelt larvae and juveniles into the "zone of influence", upstream of Collinsville. Flows that move X2 downstream of Collinsville, such as the Chipps Island flows in the proposed EPA water quality standards, are needed to move delta smelt away from this zone of influence. When delta smelt are moved into this zone, they are subjected to increased entrainment from both State and Federal pumps and agricultural diversions. Salvage of juvenile delta smelt is inversely related to Delta outflow (DWR and Reclamation 1994)(Figure 4b). The SWP historically salvages more delta smelt than the CVP (D. Sweetnam, DFG, pers. comm., 1994), possibly because it pumps more water from the Sacramento River where many delta smelt spawn. Based on analyses for the SWP, there appears to be a substantial increase in entrainment when outflow levels drop below about 10,000 cfs (DWR and Reclamation 1994). This relationship has broken down over the past two years, possibly because of Delta Cross Channel gate closure. Continuing the CVP and SWP operations, as proposed, would perpetuate these adverse effects and contribute to the continued decline of the delta smelt.

San Joaquin River Transport Flows

Proposed operations of the CVP and SWP do not provide for an outflow component from the San Joaquin River when monthly flow is less than the following: about 11,000 cfs from August to April; 6,000 cfs in May and June; and 9,200 cfs in July (Burke, Reclamation, pers comm., 1994). There are also no proposed flows for April to move delta smelt larvae spawned on the San Joaquin

River to suitable rearing habitat in Suisun Bay. Prior to agricultural diversions and the construction of the CVP and SWP, fresh water flowed down the San Joaquin River, and attracted spawning delta smelt to its fresh water channel edges and tributary sloughs. Over time, the delta smelt established a distinct spawning population in the San Joaquin River, and now requires an outflow component to move juveniles and larvae toward eastern Suisun Bay and to possibly stimulate future adult up-stream migration (Moyle, UCD, pers. comm., 1994). However, San Joaquin River water, downstream of Sack Dam, now contains contaminants that enter the system from agricultural drains. This contaminated water likely adversely affects delta smelt and its food organisms as has been observed for juvenile chinook salmon and striped bass (Saiki *et al.* 1992). The proposed operations do not provide high quality water down the San Joaquin River to maintain transport and attractant flows and dilute and minimize the adverse effects associated with contaminants. Additional sources of water potentially available to provide San Joaquin River outflow include "temporary water supplies". Temporary water supplies are those made possible as a result of an unusually large water supply not otherwise storable for project purposes, or infrequent and otherwise unmanaged flood flows of short duration. Under temporary contracts that do not exceed one year, these flows can be made available for agricultural purposes to lands without regard to the acreage limitation and full-cost provisions of Federal Reclamation law. By not proposing to use this type of water for instream purposes, and instead reserving this water for agricultural and municipal purposes, the proposed project will perpetuate the continued unavailability of San Joaquin River flows.

Presence of Delta Smelt Upstream of the Confluence in July-August

In years when peak spawning occurs late in the year, the proposed operations do not provide flows to move delta smelt larvae and juveniles in July and August to suitable rearing habitat in Suisun Bay. Operation of the CVP and SWP pumping plants in the summer months are particularly harmful to delta smelt. This is especially true when delta smelt spawn late and are not well distributed. An area extending eastward from Carquinez Strait, including Suisun Bay, Grizzly Bay, Honker Bay, Montezuma Slough and its tributary sloughs, up the Sacramento River to its confluence with Three Mile Slough, and south along the San Joaquin River, including Big Break, defines the specific geographic area critical to the maintenance of suitable rearing habitat.

The proposed operations will not provide additional "pulse" flows when delta smelt spawn late in the season or when the summer townet survey indicates that delta smelt are not distributed widely throughout the Delta. Therefore, in years when the delta smelt numbers are low and distribution poor, larvae and juveniles will be especially vulnerable to entrainment.

Suisun Marsh Salinity Control Structure

When the SMSCS is in operation, the flashboards and radial gates impair free movement of delta smelt into or out of Montezuma Slough. The twice daily

closure of radial gates may slow the movement of the delta smelt out of Montezuma Slough, and may increase the likelihood of entrainment due to private and State-owned diversions. When the radial gates are opened, higher velocities and turbulence may occur causing increased stress, disorientation, and greater risk of predation. Suisun Marsh is an important area that allows wide geographic distribution of delta smelt.

Entrainment and Predation at the Pumps, Barker Slough and Roaring River Diversion

The proposed action does not include curtailments in pumping to mitigate for entrainment at the pumping plants other than those required by SWRCB D-1485 and the winter-run chinook salmon biological opinion. The DWR Particle Tracking Model indicates that the export pumps have a "zone of influence" in the interior Delta from which a large percentage of modeled particles were entrained (DWR and Reclamation 1993). When delta smelt are in or near the interior Delta, losses from entrainment will increase. Furthermore, reverse flows, which are a consequence of pumping, move delta smelt into the "zone of influence", thus decreasing their distribution and increasing the likelihood of entrainment. During December through March, delta smelt adults migrate upstream from Suisun Bay and into the lower Sacramento and San Joaquin rivers to spawn. This is the most important life-stage in determining the abundance of the following year's recruitment (Herbold, EPA, pers. comm.). Losses of these adults occur when CVP and SWP pumping entrains these fish as they migrate upstream into the "zone of influence" of the pumps. In all water-year types, these adult spawners must have protection from entrainment. Larval and juvenile delta smelt migrate downstream from the Delta to Suisun Bay from February through June. These life-stages float passively downstream with flows and are easily entrained when in the influence of the pumping plants. In wet, above normal, and below normal water-years, abundance of these life-stages is relatively high compared to dry and critically dry years when more protection is necessary. The average yearly estimated larval entrainment at the CVP and SWP Delta facilities for 1989 through 1993 was 590,200 larvae with a range of 41,000 larvae in 1991 to 1,199,000 larvae in 1992 for the combined facilities; however, sampling was not done during critical periods in 1991 and 1993 due to boat breakdown, consequently these numbers are low (DWR and Reclamation 1994). Larval sampling at south and central Delta sites indicates that the months when entrainment occurs are February through June (DWR and Reclamation 1994). In most of the wetter years, spawning is earlier and juveniles that survive to July and August are important to recruitment for the next year class. Delta smelt spawn in July and August in some of the dryer years. Larvae and juveniles produced by this late spawning are susceptible to entrainment at a time when diversions are high in the Delta. The summer townet survey indicates the abundance of this life-stage during July (Figure 6b). A summer townet index with a range of about 14 to 19 would be most suitable for delta smelt. This represents the range between the mean for wet, above normal, and below normal water-years from 1959 to 1993 (14.39) and the mean for all water-year types from 1959 to 1982 (19.5)(Figure 6b). If flows have moved and maintained larvae and juveniles in Suisun Bay, entrainment is

least likely in September through November.

Predation occurs concurrent with entrainment because striped bass and other predator fish accumulate at the pumping plants and other diversions where delta smelt are drawn due to the influence of the pumps. The high flows and turbulence associated with these diversions disorient fish making them highly susceptible to predation (Coulston, DFG, pers. comm.).

CVP and SWP have not proposed changing operations at the salvage facilities to increase survival of salvaged delta smelt. Practices at the salvage facilities result in substantial losses of delta smelt. Louvering is targeted at salmon and striped bass and may not be effective for delta smelt and Sacramento splittail. The proposed fish release sites may not be appropriate for various life-stages of the delta smelt and the Sacramento splittail and may allow additional predation of these species at the point of release. Predation in Clifton Court Forebay is a significant source of fish mortality.

The proposed CVP and SWP actions do not include reducing diversions from Barker Slough during the delta smelt spawning interval. Adult delta smelt spawn in Barker Slough from February through August. This spawning area is thought to be one of the most important in the Delta (Sweetnam, DFG, pers. comm.). DWR has proposed additional diversions from Barker Slough through the North Bay Aqueduct during the spawning period. Entrainment of delta smelt larvae at the Barker Slough intake in 1993 and 1994 is estimated to have been 8,289 and 22,489 individuals, respectively (DWR and Reclamation 1994). The proposed CVP and SWP actions do not include changing approach velocities at the Roaring River Diversion screen in Montezuma Slough. Larval delta smelt were collected at three stations in Montezuma Slough during special purse seine sampling from June 7 through 9, 1994. Estimates of delta smelt abundance for this period were 1.37, 1.37, and 54.11 delta smelt/AF, respectively (DWR and Reclamation 1994). The abundance estimate of 54.11 delta smelt/ AF was derived from sampling near the Roaring River Diversion. Because Montezuma Slough represents a key location where distribution of delta smelt reduces the risk of extinction of the species (Draft Delta Native Fishes Recovery Plan 1994), losses should be minimized to below five delta smelt/AF. The Roaring River Diversion in Montezuma Slough is screened using DFG requirements for salmon. This requirement does not fully address delta smelt needs. Both of these diversions attract predators that add to losses of delta smelt.

The proposed CVP and SWP actions do not include reducing diversions from Rock Slough during the delta smelt spawning interval. Contra Costa Canal carries 50 to 250 cfs taken from an unscreened intake at Rock Slough in Old River. Because delta smelt adults are in this area, lack of screening creates potential for entrainment. Large spawning areas for delta smelt lie just north of the intake at Twitchell Island. The unscreened intake at Rock Slough is responsible for losses that have been estimated at about 7,300 delta smelt larvae for 1992 and 13,000 larvae for 1993 (Spaar 1988 as cited in DWR and Reclamation 1994). In 1992, delta smelt larvae were entrained at 7.91

larvae/AF in March and 8.68 larvae/AF in April. In 1993, delta smelt larvae were entrained at 4.89 larvae/AF in March and 6.36 larvae/AF in April. These estimates may not be representative of actual entrainment because of the location of the sampling sites and tidal influences at these sites (DWR and Reclamation 1994); therefore, entrainment rates may actually be higher than those reported above. The affected delta smelt are most likely killed. Predatory fish reside near the Rock Slough intake and add to the loss of delta smelt. Continued operation of the Rock Slough diversion, as proposed, are likely to perpetuate the long-term decline in the delta smelt population.

Proposed Delta Smelt Critical Habitat

Because one of the most important existing requirements identified in Service (1994d) was the maintenance of the 2 ppt isohaline in Suisun Bay to provide rearing habitat for juvenile delta smelt, effects of CVP and SWP operations on proposed critical habitat are similar to those that affect the continued existence of the species. As described above, high diversion and export rates of surface water inflows, in combination with upstream water storage management practices and operations, that will move the 2 ppt isohaline upstream of Suisun Bay during the late winter through early summer months, will adversely modify or destroy proposed critical habitat for the delta smelt.

Sacramento Splittail

Sacramento splittail young-of-the-year and adults also are entrained by the Federal and State pumping plants. The largest losses at the pumping plants occur in wet years when thousands of splittail young are lost during the spring months. High levels of wet-year recruitment are important to sustain splittail populations during drought years and to reverse the long-term decline of this species. The Sacramento splittail is found at the Rock Slough intake (P. Coulston, DFG, pers. comm.) and is susceptible to entrainment at the Contra Costa diversion. In addition, proposed CVP and SWP operations do not provide adequate flows for splittail spawning and rearing habitat or transport flows to move young downstream.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, local, or private actions affecting listed species and their critical habitat that are reasonably certain to occur in the area considered in this biological opinion. Future Federal actions not related to this proposed action are not considered in determining the cumulative effects, but are subject to separate consultation requirements pursuant to section 7 of the Act.

Cumulative effects on the delta smelt or its proposed critical habitat include any continuing or future diversions of water that may entrain adult or larval fish or that may decrease outflows incrementally, thus shifting upstream the position of the delta smelt's preferred habitat. Water diversions through

intakes serving numerous small, private agricultural lands and duck clubs in the Delta, upstream of the Delta, and in Suisun Bay contribute to these cumulative effects. These diversions also include municipal and industrial uses, as well as providing water for power plants. State or local levee maintenance and channel dredging activities also destroy or adversely modify critical habitat by disturbing spawning or rearing habitat. Delta smelt adults seek shallow, tidally-influenced, fresh water (*i.e.*, less than 2 ppt salinity) backwater sloughs and edgewaters for spawning. To assure egg hatching and larval viability, spawning areas also must provide suitable water quality (*i.e.*, low concentrations of contaminants) and substrates for egg attachment (*e.g.*, submerged tree roots, branches, and emergent vegetation). Suitable water quality must be provided by addressing point sources of contaminants so that maturation is not impaired by pollutant concentrations. Levee maintenance and channel dredging disturbs spawning and rearing habitat, and resuspends contaminants into these waters.

Of the entities with water storage greater than 100,000 AF, Reclamation represents 40.6% of Delta water, 42.8% of Sacramento River water, and 37.7% of San Joaquin River water, respectively. DWR represents 17.4 percent of Delta water, 29 percent of Sacramento River water, and has no storage for San Joaquin River water. Therefore, the non-Federal entities (excluding DWR) represent 42.0 percent of Delta water, 28.2% of Sacramento River water, and 62.3% of San Joaquin River water, respectively, of those with storage greater than 100,000 AF. Collectively, these non-Federal entities (excluding DWR whose activities were analyzed as part of the proposed Federal action) contribute to the existing deleterious effects of the baseline and proposed action by removing water and thus decreasing Delta outflows. These Delta outflows would otherwise transport larvae and juveniles to suitable rearing habitat and maintain that habitat in a suitable geographic location away from Delta diversions.

Although the cumulative effects of non-Federal entities substantially contribute to the existing adverse environmental baseline and project effects, other adverse effects also contribute. These additional effects include point and non-point source chemical contaminant discharges. These contaminants include selenium and numerous pesticides and herbicides associated with discharges related to agricultural and urban activities. Implicated as potential sources of mortality for delta smelt and Sacramento splittail, these contaminants may adversely affect delta smelt and Sacramento splittail reproductive success and survival rates. Spawning habitat may also be affected if submerged aquatic plants used as substrates for adhesive egg attachment are lost due to toxic substances. As can be seen in Figure 7b, the low 1994 fall midwater trawl index is an indication that these effects combined with the water project effects discussed above are perpetuating the decline of delta smelt.

These effects will continue until long-term actions (such as those discussed below) allow for substantial habitat improvement.

CONCLUSION

The proposed action involves the diversion of a high percentage of Delta outflow resulting in a lack of transport and habitat flows for the delta smelt and the Sacramento splittail which are the primary causes for their decline in terms of reproduction, numbers, and distribution. Delta outflow must have both Sacramento and San Joaquin river components to adequately transport and provide behavioral cues to larvae and juveniles, and to ensure appropriate rearing conditions in Suisun Bay. The proposed project includes operations that result in delta smelt and Sacramento splittail remaining in areas upstream of the Sacramento-San Joaquin confluence which increases the vulnerability of these species to entrainment, predation, and contaminants.

The proposed action represents a continuation of CVP and SWP operations as they occurred prior to 1993, will perpetuate the decline of delta smelt and Sacramento splittail populations (through reductions of reproduction, numbers, and distribution) which occurred during the 20 years before 1993, and will appreciably reduce the likelihood of their recovery. The survival and recovery of these species cannot be ensured by the continuation of these declines.

After reviewing the current status of the delta smelt and the Sacramento splittail, the environmental baseline, the effects of the proposed CVP and SWP operations and the cumulative effects, it is the Service's biological opinion that the CVP and SWP operations, as proposed, are likely to jeopardize the continued existence of the delta smelt and the proposed threatened Sacramento splittail, and result in the destruction or adverse modification of proposed critical habitat for the delta smelt. Implementation of the Framework Agreement, State Board adoption of equivalent EPA water quality standards, and eventual implementation of the Bay-Delta water quality standards are key components of the types of actions that are necessary to conserve these species.

REASONABLE AND PRUDENT ALTERNATIVE

Regulations (50 CFR 402.02) implementing section 7 define reasonable and prudent alternatives as alternative actions, identified during formal consultation, that (1) can be implemented in a manner consistent with the intended purpose of the action, (2) can be implemented consistent with the scope of the action agency's legal authority and jurisdiction, (3) are economically and technologically feasible, and (4) would, the Service believes, avoid the likelihood of jeopardizing the continued existence of listed species and the destruction or adverse modification of critical habitat.

NMFS's February 4, 1993, winter-run chinook salmon biological opinion provides protection, in part, for the delta smelt, proposed critical habitat, and the Sacramento splittail. This protection consists of: (1) use of the 90 percent probability of exceedance forecast; (2) QWEST exceeding zero cfs from February

1 through April 30; and (3) QWEST of -2,000 cfs from November 1 through January 31. All life-stages of delta smelt and Sacramento splittail are benefitted through these restrictions as described above.

EPA and the Service have coordinated in the promulgation of water quality standards for the Estuary and designation of critical habitat for the delta smelt. NMFS and the CVPIA team have also been part of this effort to provide actions beneficial to the Estuary. As a result of this coordination, the following reasonable and prudent alternative is an incremental improvement to water quality-based habitat requirements for the delta smelt and the Sacramento splittail. The Service recognizes that immediate, full implementation of Bay-Delta water quality standards and other beneficial actions may not be possible. However, if full implementation of these standards are not phased in by the non-Federal entities mentioned above, then Reclamation and DWR will be responsible for full implementation of these actions which are necessary to improve water quality-based habitat conditions for the delta smelt and Sacramento splittail.

Based on the analysis of impacts described above in the **EFFECTS OF THE PROPOSED ACTION** section, several operational and project modifications are needed to avoid jeopardizing the continued existence of the delta smelt (and the proposed threatened Sacramento splittail, and destruction or adverse modification of proposed delta smelt critical habitat). Therefore, the Service provides the following reasonable and prudent alternative to assist in the long-term operation of the CVP and SWP. The components of this alternative deal with: (1) habitat and transport flows; (2) San Joaquin River flows; (3) presence of delta smelt upstream of the Confluence in July-August as a result of a late spawning period; (4) the Suisun Marsh Salinity Control Structure; (5) combined salvage at Federal and State Fish Facilities; (6) North Bay Aqueduct diversion at Barker Slough, and Prospect Island; and (7) CVP and SWP implementation of EPA Bay-Delta Salinity standards. These components minimize project effects on the delta smelt (and the proposed threatened Sacramento splittail, and proposed critical habitat for the delta smelt) through various biologically justifiable methods: (1) habitat and transport flows act to move delta smelt larvae and juveniles in the Sacramento and San Joaquin drainages to rearing habitat in Suisun Bay away from the influence of the Federal and State pumping plants, and maintain that habitat in a suitable geographic location; (2) San Joaquin River flows supplement these flows in April and May and move delta smelt larvae and juveniles on this side of the Delta to rearing habitat in Suisun Bay; (3) when delta smelt spawn late in July-August, and larvae and juveniles remain upstream because required flows have occurred earlier, provisions for supplementary flows are necessary to move fish to rearing habitat in Suisun Bay; (4) the Suisun Marsh Salinity Control Structure operations are modified to allow free movement of delta smelt into and out of Montezuma Slough; (5) a threshold value which will trigger actions to reduce combined salvage of delta smelt at the Federal and State Fish Facilities is established; (6) the North Bay Aqueduct diversion is modified to limit entrainment when delta smelt larvae are present; and (7) if the SWRCB does not implement EPA Bay-Delta Salinity Standards or promulgate

and implement equivalent standards, the CVP and SWP will assume full responsibility for implementing Bay-Delta salinity standards to increase the likelihood of the survival and recovery of delta smelt. This reasonable and prudent alternative minimizes project effects and avoids the likelihood of jeopardizing the continued existence of listed and proposed species, and the destruction or adverse modification of proposed critical habitat from the CVP and SWP.

DELTA SMELT

(1) **Habitat and Transport Flows**

Reclamation and DWR shall ensure that X2 is placed downstream of Collinsville for 150 days between February 1 and June 30 in all water years. In addition, Reclamation and DWR shall ensure net Delta outflows of 11,400 cfs during this period in accordance with Table 3a below. Compliance with these requirements shall be based on outflow and salinity measurements, not inflow, because the placement of X2 and net Delta outflow cannot easily be related to inflow.

(a) The 2 ppt isohaline (X2) is defined to be met with a mean daily surface EC of 2.640 milli-siemens/cm (mS/cm). The computation of salinity at Collinsville shall be based on a mean daily average electroconductivity (EC) at the Collinsville gauge.

(b) Compliance with the requirement of positioning X2 downstream of Collinsville will be determined by one of two means: (1) a mean-daily EC at Collinsville of 2.640 mS/cm as estimated from the Collinsville gauge; or (2) a 14-day running average EC of 2.640 mS/cm. Compliance with the requirement for 11,400 cfs days will include: (1) a mean-daily EC at Chipps Island of 2.640 mS/cm as estimated from the Mallard station; (2) a 14-day running average EC of 2.640 mS/cm; and (3) a 7-day running average Delta Outflow Index (DOI) greater than or equal to 11,400 cfs with a daily DOI not less than 10,000 cfs.

Other methods for determining compliance may be developed. Such proposals will be submitted to the Service for review and approval prior to implementation.

(c) Water-year classifications shall be based on the forecasted (90 percent probability of exceedance) Sacramento River Index (SRI) as defined in SWRCB D-1485. SWRCB D-1485 defines a split classification for water-year type based on agricultural, municipal and industrial uses, and fish and wildlife uses, in years following a critical year. DWR's Bulletin-120 published forecasts will be used to initially classify the water year in February, and update the classification in March, April, and May. The May Bulletin-120 forecast will finalize the classification of the water year. Until publication of DWR's February Bulletin-120 forecast (about February 10), a preliminary forecast of the SRI will be

used. A sliding scale (to allow a smooth transition between water-year types) will be used in all water-year types to provide the number of days listed in Table 3a for 11,400 cfs outflow. In the event that the water-year classification changes to a wetter year, which requires more days of compliance than remain in the period, then the flow need only be maintained to June 30.

(d) In the period from February 1 through June 30, a minimum average San Joaquin River component of the flows maintaining X2 and 11,400 cfs flows shown in Table 3b below shall be provided in every water-year type.

(e) The Service recognizes that strict adherence to the required transport and habitat flows may not be reasonable and prudent under certain adverse hydrologic conditions, such as those experienced in the 1976 and 1977 critical dry years. If under adverse operational or hydrologic conditions, it is determined by the Service that meeting these criteria would result in a conflict with protection of other threatened and endangered species or otherwise require actions that would not be reasonable or prudent, then Reclamation and DWR may immediately reinitiate consultation to determine appropriate modifications.

(f) If under adverse operational or hydrologic conditions, it is determined by the Service that there is a conflict with winter-run chinook salmon or other listed species, NMFS and the Service will meet to determine necessary actions.

(g) If monitoring indicates that the flows specified below are not sufficient to maintain rearing habitat for delta smelt away from the southern and central Delta, then the Working Group defined in the Reporting Requirements below, will convene and make a recommendation to the Coordination Group defined in Exhibit B of the Framework Agreement. The Coordination Group shall then recommend an appropriate action to the Service within 10 days to protect delta smelt. Based on these recommendations, Reclamation and DWR will reinitiate section 7 consultation, or submit to the Service for approval prior to implementation, recommendations for project changes to protect the delta smelt.

Table 3a. Minimum number of days between February 1 and June 30 that net Delta outflows of 11,400 cfs must be provided in wet, above normal, below normal, dry, and critically dry water-years (based on Delta outflow from DWR's DAYFLOW for 1955-1991) and the percent of the 71-year historical record (1922-1993) in which a given water-year type occurred.

OUTFLOW/ WATER-YEAR TYPE	WET	ABOVE NORMAL	BELOW NORMAL	DRY	CRITICAL DRY
11,400 cfs (% 71-year record)	150 days (29)	150 days (13)	85 days (20)	64 days (22)	18 days (16)

Table 3b. Minimum average San Joaquin River flow components as measured at Vernalis. Flow components are percentages of the 7,100 cfs (X2 flows) and 11,400 cfs required flows between February 1 and June 30 listed in Table 3a. See Table 3a for number of days required.

WATER-YEAR TYPE	Wet	Above Normal	Below Normal	Dry	Critical Dry
SAN JOAQUIN RIVER COMPONENT	30[1] percent	30 percent	20 percent	20 percent	10 percent

[1]Rounded off to nearest 10. For example, 10 percent of a 11,400 cfs outflow would be a 1,140 cfs flow as measured at Vernalis.

Biological Justification: See Service 1994d. Sacramento and San Joaquin river flows are essential to transporting and maintaining the delta smelt in suitable rearing habitat downstream of the confluence, and at Chipps and Roe islands. By using salinity to measure compliance with the positioning requirement, X2 is placed at or downstream of the Sacramento and San Joaquin river confluence. Delta smelt are moved out of the influence of the CVP and SWP pumps with this placement of X2, and when 11,400 cfs flows are provided, rearing habitat is moved to a location that historically has improved delta smelt abundance (Figures 4a, 9). The two or three ways to comply with the X2 positioning flows and 11,400 cfs flow requirements, identified in (b) above, were determined by DWR. These compliance measures allow operational flexibility while maintaining the transport and habitat outflows.

(2) **San Joaquin River Flows**

In addition to the San Joaquin River flows stipulated under Table 3b[1], Reclamation shall provide the following 30-day average flows at Vernalis for a 30-day period from April 1 through May 15 starting on the first neap tide in April: 2,400 cfs in critical years; 2,600 cfs in dry years; 3,200 cfs in below normal years; 3,600 cfs in above normal years; and 5,200 cfs in wet years.

For example, an April flow of 1,140 cfs at Vernalis (i.e., 10 percent of 11,400 cfs) is required at the second neap tide with an additional flow of 2,400 cfs in a critical year to make a total flow at Vernalis of 3,540 cfs.

[1] Net Delta outflow would not increase above X2 positioning flow at confluence or 11,400 cfs flow.

Biological Justification: The proposed long-term operation of the CVP and SWP does not provide for minimum flows down the San Joaquin River, other than those required from New Melones Reservoir to meet SWRCB D-1485 salinity standards in the south Delta. The San Joaquin River and tributary sloughs are delta smelt spawning habitat that require flows from April 1 to May 15 to move larvae and juveniles toward Suisun Bay. Because of the relative scarcity of water available from the San Joaquin River drainage, flows provided in the first requirement of the reasonable and prudent alternative may not be adequate in some years to transport larvae and juveniles out of the south and central Delta toward Suisun Bay.

(3) **Presence of Delta Smelt Upstream of the Confluence in July-August as a Result of a Late Spawning Period**

If the summer townet survey shows that delta smelt are not found distributed in 3 out of 7 Suisun Bay stations 405-519 and 4 out of 8 Montezuma Slough/Sacramento River stations 513-707, then Reclamation and DWR shall convene the Working Group and make a recommendation to the Coordination Group defined in Exhibit B of the Framework Agreement. The Coordination Group shall then recommend an appropriate action to the Service within 10 days of the results of the townet survey being available that minimizes entrainment of delta smelt and maximizes downstream movement of fish away from the pumps. The Service shall make the final determination necessary for protecting the delta smelt. Reclamation and DWR may do one or more of the following:

(a) Modify combined Federal and State pumping to a level and for a length of time that allows delta smelt to move out of the area.

(b) Provide Delta outflow with Sacramento and San Joaquin river components similar to Table 3b above, with maximum downstream movement provided by the next neap tidal cycle.

(c) Open Delta Cross Channel gates until sampling shows delta smelt present at the above stations.

(d) If an April or May townet survey, or other sampling method, show delta smelt not distributed in the above stations, provide a 14-day, 11,400 cfs outflow with Sacramento and San Joaquin river components as in 3b above, at the second neap tide in April, May or June. A suggested modification of the 150-day requirement for X2 positioning outflows in May and June in critical dry conditions to make water available for this 11,400 cfs pulse flow would be to substitute a curtailment of combined pumping at the CVP and SWP of 1,500 cfs.

(e) Provide other, similar actions that either move delta smelt larvae and juveniles downstream to rearing habitat or prevent entrainment until juveniles develop swimming capacity to move out of the area.

Biological Justification: See Service 1994d.

(4) **Suisun Marsh Salinity Control Structure**

DWR shall operate the salinity gates only as required to meet existing Suisun Marsh salinity standards. When not operating, the gates shall remain in the raised position.

Biological Justification: See Service 1994d.

(5) **Salvage at Federal and State Facilities**

If the 14-day running average of the combined salvage of delta smelt juveniles and adults at the Federal and State salvage facilities is 400 or more, then Reclamation and DWR may do one or more of the following:

(a) Modify the combined Federal and State pumping to a level and for a length of time that allows delta smelt to move out of the area.

(b) Provide Delta outflow with Sacramento and San Joaquin river components similar to Table 3b above, with maximum downstream movement provided by the next neap tidal cycle.

(c) Open Delta Cross Channel gates until 14-day running average of combined salvage has decreased.

(d) Provide a minimum 14 days (Table 3a, below) of 11,400 cfs outflow commencing at the second neap tide in April to move delta smelt larvae and juveniles away from the pumps.

(e) Convene the Working Group and make a recommendation to the Coordination Group defined in Exhibit B of the Framework Agreement. The Coordination Group then recommends an appropriate action to the

Service within 10 days of the exceedance of 400 that minimizes entrainment of delta smelt and maximizes downstream movement of fish away from the pumps. The Service will make the final determination necessary to protect delta smelt.

Biological Justification: The appearance of delta smelt at the salvage facilities correlates with upstream migrating adults, downstream migrating juveniles and larvae, the leading edge of neap tides (Lloyd Hess, Reclamation, pers. comm.), and the magnitude of export pumping. Spikes in salvage numbers occur as a result of the interaction of these factors. At the Western Division American Fisheries Society Meeting in July 1993, a relationship was demonstrated between combined Federal and State pumping at or below 2,000 cfs and a decrease in salvage rates of delta smelt (Reclamation 1993). Combined 1980-1992 pumping for the Federal and State Facilities was graphed against 1980-1992 combined salvage data. The 2,000 cfs combined pumping value mentioned above intersected with the combined salvage at a value of 400. In the Service's May 26, 1993, delta smelt biological opinion, 400 was used as an incidental take limit. Thus, 400 is a biologically and operationally valid threshold value. Since numbers of salvaged delta smelt could be expanded by a factor representing losses due to screen efficiency, predation, and handling, it is also a conservative threshold value.

(6) **North Bay Aqueduct Diversion at Barker Slough and Prospect Island**

(a) When monitoring at Barker Slough indicates the presence of delta smelt larvae (under 20 mm), diversions from Barker Slough shall be reduced to a 5-day running average rate of 65 cfs not to exceed a 75 cfs daily average for any day, for a minimum of 5 days, and when monitoring shows no delta smelt are present. Presence is defined as a weighted average of one or more larval delta smelt sampled at Barker Slough stations 720, 720a (between stations 720 and 721), and 721 during a single sampling day. Barker Slough monitoring stations shall be weighted as follows:

station 720-- 20 percent
station 720a (between stations 720 and 721)-- 30 percent
station 721-- 50 percent

If replicate samples are taken, the count used at each monitoring station shall be the average of all replicate samples taken at the monitoring station.

The averaging period for the 65 cfs shall begin 24 hours after the presence of delta smelt is detected. The Service shall be notified within 24 hours when diversions are reduced due to the presence of delta smelt juveniles and larvae and when diversions are subsequently increased due to the absence of delta smelt juveniles and larvae.

(b) A monitoring plan will be developed and submitted to the Service to provide baseline information to allow an estimation of delta smelt numbers and distribution in the Barker/Lindsey/Cache Slough-Prospect Island area. If this monitoring shows increases in delta smelt numbers and distribution when Prospect Island has become operational as a shallow-water habitat, the Working Group will meet and make a recommendation to the Service to amend 5(a) above.

Biological Justification: Barker Slough has been identified as a spawning area for delta smelt. The number of delta smelt larvae entrained at the NBA diversion on Barker Slough has been estimated to range from 37 to 1,700 larvae/day using 1993-94 data (DWR and Reclamation 1994). Curtailment of the NBA rate of diversion is the only method of decreasing this entrainment.

Prospect Island is a Federal project to create a shallow-water habitat in the Delta by breaching levees. Prospect Island is located about four miles from the Barker Slough Pumping Plant of the NBA. One reason for designing Prospect Island as shallow-water habitat is to create habitat for delta smelt and other native fish and allow increases in numbers and distribution.

(7) **CVP and SWP Implementation of Delta Smelt Protective Measures Contained Within EPA Bay-Delta Salinity Standards**

If the SWRCB does not implement EPA Bay-Delta salinity standards or promulgate and implement equivalent standards which provide adequate protection to the delta smelt (e.g., the Roe Island standard) within 3 years of the issuance of this biological opinion, then the CVP and SWP shall be responsible for full compliance.

Biological Justification: Because delta smelt have survived the 1986-1992 drought with past project operations, phased implementation of delta smelt protective measures can occur for the short-term. The rebound in delta smelt abundance and distribution in 1993 with a wet year and a delta smelt biological opinion in place, support this phasing of implementation. However, as experienced in the critical dry 1994 water-year that followed, which had delta smelt protective measures in place (Service 1994d), a substantial decline in the fall midwater trawl index occurred (Figure 3b). This change from high delta smelt abundance and distribution followed immediately by low abundance and distribution is reflective of the population variability of this annual species. In consideration of this variability, full compliance with measures such as the Roe Island standard contained within EPA Bay-Delta standards are needed to ensure that the likelihood of delta smelt and Sacramento splittail long-term survival and recovery will not be appreciably reduced. Thus, if the SWRCB does not promulgate standards that benefit delta smelt (and the Sacramento splittail should this species be listed), then the CVP and SWP must fully implement these standards to avoid jeopardizing the long-term survival and recovery of listed species, and destruction or adverse modification of critical habitat (if such designation occurs).

Proposed Delta Smelt Critical Habitat

Habitat and Transport Flows

Outflow shall be provided that maintains the 2 ppt isohaline (X2) in suitable rearing habitat for a number of days determined by early precipitation patterns each year and antecedent conditions from February 1 through June 30.

Biological Justification: Herbold (as cited in DWR and Reclamation 1994) has shown a relationship between the position of X2 and the abundance of delta smelt measured by the fall midwater trawl survey (Figure 9). The draft Delta Native Fishes Recovery Plan also discusses the need to place X2 downstream of the confluence to improve conditions for the seven species considered therein. See also the biological justification for delta smelt habitat and transport flows discussed above.

Sacramento Splittail

(1) **Habitat and Transport Flows**

The flows provided by the reasonable and prudent alternative for the delta smelt will provide adequate lower river transport and habitat flows for the Sacramento splittail.

Biological Justification: The Sacramento splittail also needs flows to transport juveniles to suitable rearing habitat and maintain that habitat downstream of the confluence, including Chipps and Roe islands.

(2) If the combined Federal and State salvage is 50 percent of the monthly take limit, as defined in Table 5 below, by the 15th day of the appropriate month, then Reclamation and DWR may do one or more of the following:

(a) Modify the combined Federal and State pumping to a level and for a length of time that allows Sacramento splittail to move out of the area.

(b) Provide Delta outflow with Sacramento and San Joaquin river components similar to those specified in Table 3b above, with maximum downstream movement provided by the next neap tidal cycle.

(c) Provide a 14-day pulse flow of 11,400 cfs in April with Sacramento and San Joaquin river components similar to that specified in Table 3b above, with maximum downstream movement provided by the next neap tidal cycle.

(d) Convene the Working Group and make a recommendation to the Coordination Group defined in Exhibit B of the Framework Agreement.

The Coordination Group then recommends an appropriate action to the Service within 10 days of the exceedance of 50 percent of the monthly total take limit that minimizes entrainment of Sacramento splittail and maximizes downstream movement of fish away from the pumps. The Service shall make the final determination necessary to protect the Sacramento splittail.

Biological Justification: Using the combined salvage of 50 percent of the monthly total allowable take as a threshold for initiating remedial measures should allow adequate time for actions to take place that will subsequently reduce the rate of salvage. During the 1984-1992 period, Sacramento splittail were declining in numbers and so this represents a conservative trigger for potential actions to occur.

Incidental Take

Sections 4(d) and 9 of the Act, as amended, prohibit taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct) of listed species of fish or wildlife without a special exemption. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harass is defined as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is any take of listed animal species that results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by Reclamation or the applicant. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of Reclamation's action is not considered a prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are nondiscretionary and must be implemented by Reclamation so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, in order for the exemption in section 7(o)(2) to apply. Reclamation has a continuing duty to regulate the activity that is covered by this incidental take statement. If the Federal agency (1) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

The Service has developed the following incidental take statement based on the premise that the reasonable and prudent alternative will be implemented. The Service anticipates that operations of the CVP and SWP will result in the take (by killing) of delta smelt (see Table 4). This take includes that incurred by salvage activities and studies undertaken by Reclamation, DWR, and CCWD

through IEP addressing the delta smelt in particular, and other fishery studies in the Delta that may provide information on the delta smelt. Adults, juveniles, and larvae are present in the south Delta from January through July. Larvae and juvenile delta smelt are flushed to the eastern Suisun Bay by outflows during this interval and removed from the influence of most direct project effects through June 30. With implementation of the reasonable and prudent measures described below, the incidental take of all delta smelt entrained as a result of water exports by the long-term CVP and SWP operations described above will not be considered a prohibited taking.

The Service anticipates that operating the Tracy and Skinner Fish Facilities will result in the take and loss of delta smelt. Additionally, take is expected at the Barker Slough intake on the North Bay Aqueduct and the Rock Slough intake with the Contra Costa Canal. To allow implementation of studies associated with the action addressed by this biological opinion, the take resulting in the death of up to 10,000 larval delta smelt and an additional 10,000 juvenile and adult delta smelt from ongoing fishery studies conducted by Reclamation, DWR, and the IEP group is covered by this incidental take statement until changes occur that require reinitiation of consultation.

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take of the delta smelt:

(1) Improve salvage operations at the Tracy and Skinner Fish Protection Facilities during the spawning period.

(2) Minimize take at the Tracy and Skinner Fish Protection Facilities.

(3) Minimize take at the North Bay Aqueduct intake on Barker Slough during the spawning period.

(4) Minimize take at the Roaring River Diversion in Montezuma Slough.

(5) Minimize take at CCWD diversions.

In order to be exempt from the prohibitions of section 9 of the Act, Reclamation and DWR must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary:

(1) Between December 1 and March 30, "loads" of salvaged fish from the CVP and SWP salvage facilities shall be transported to a new release site whenever the number of adult delta smelt observed in any salvage count preceding a "load" exceeds 0.5 adult delta smelt per count minute. The threshold abundance value (0.5 adult delta smelt) triggering this action may be adjusted by the Working Group if it is apparent that too few or too many loads are being transported to the new release site. Delta smelt handling techniques developed by Joe Cech and Tina Swanson at UCD shall be modified for use at the salvage facilities. Salt shall be added

to maintain an 8 ppt salinity in transport water for trucking delta smelt during this period, and this requirement shall be modified to increase survival consistent with the Cech and Swanson modifications. At the Tracy and Skinner Fish Protection Facilities, between the issuance of this biological opinion and July 31 of any given year, fish shall not be held more than 8 hours before beginning transport to a release site.

(2) CVP and SWP shall use the following table to calculate take at the CVP and SWP fish salvage facilities on a monthly basis. If reasonable operation of the CVP and SWP cannot satisfy this requirement, the Working Group (defined in the Reporting Requirements section below) shall meet to develop alternative actions.

Table 4. Monthly average salvage at the Federal and State Fish Facilities from 1980 to 1992 by water year type. Numbers are total allowable incidental take for each month by water year type.

	Above Normal	Below Normal
Months	**Top 25% of Years**	**Top 25% of Years**
January	6,187	13,354
February	10,181	10,910
March	7,920	5,368
April	4,319	12,345
May	18,300	55,277
June	13,128	47,245
July	16,208	35,550
August	7,734	25,889
September	1,739	1,986
October	22,425	6,440
November	5,256	2,001
December	804	8,052

Biological Justification: The 1980 to 1992 period was selected as representing the period when the delta smelt was declining and when identification of delta smelt was consistently accurate. We have provided additional protective measures in the reasonable and prudent alternative which provides flexibility to modify the incidental take statement in the 1994 delta smelt biological opinion. Biologically, it is more beneficial to the delta smelt if transport and habitat flows are provided that allow increased

distribution and abundance in Suisun Bay, away from the influence of the Federal and State pumps. Thus, these numbers are not likely to be salvaged at the Federal and State facilities because the above alternative will change the Delta dynamics and decrease entrainment at the Federal and State pumps.

(3) Monthly average incidental take of larvae at the Barker Slough diversion shall be the following:

January	3 larvae/acre-foot
February	4 larvae/acre-foot
March[1]	5 larvae/acre-foot
April	6 larvae/acre-foot
May[1]	7 larvae/acre-foot
June[1]	10 larvae/acre-foot
July	7 larvae/acre-foot

[1]The rounded-off values for March, April, and May are taken from the 1994 biological assessment (DWR and Reclamation 1994). January, February, April, and July values are extrapolations from this data-set.

Biological Justification: These values were in place when pumping was curtailed through the 1993 delta smelt biological opinion. Thus, these values represent a year when delta smelt were spawning in Lindsey Slough in high numbers resulting from favorable conditions of high outflow and the protective measures under the 1994 biological opinion. They represent a biologically appropriate limit when combined with pumping curtailment as in reasonable and prudent alternative number 5 above.

(4) Reclamation and DWR shall change approach velocities at the Roaring River Diversion to 0.2 feet per second by December 31, unless and until new information on a more appropriate approach velocity becomes available as a result of studies conducted in the Reporting Requirements described below. Any changes to these approach velocities shall be approved by the Service before they are implemented.

(5) To minimize take of delta smelt in the unscreened Rock Slough intake, monitoring information described in the Reporting Requirements below shall be used to determine reduction in diversion of water at the Rock Slough and Mallard Slough intakes. The intent is to minimize take of delta smelt adults, juveniles, or larvae that are exposed to pumping and diversion-related losses during the spawning and rearing period from January 1 through August 31 . Notification of proposed diversion reduction to reduce take of delta smelt shall be submitted to the Service for approval and submitted in the twice monthly report mentioned above.

Sacramento Splittail

The Service anticipates that operations of the CVP and SWP will result in the take and loss of the Sacramento splittail. This take includes that incurred

by salvage activities and studies undertaken by Reclamation, DWR, and CCWD through IEP and other fishery studies. Upon implementation of the reasonable and prudent measures below, the incidental take of all Sacramento splittail entrained as a result of exports allowed by the long-term operations described above will not be considered a prohibited taking should this species be listed. The Service anticipates that operating the Tracy and Skinner Fish Facilities will result in the take and loss of Sacramento splittail. Additionally, take is expected at the CVP and SWP controlled diversions below Colusa on the Sacramento River. To allow implementation of studies associated with the action addressed by this biological opinion, take resulting in the death of up to 10,000 larval Sacramento splittail and an additional 10,000 juvenile and adult Sacramento splittail from ongoing fishery studies conducted by Reclamation, DWR and the IEP group is covered by this incidental take statement until changes occur that require reinitiation of consultation. The measure listed below is nondiscretionary, and must be undertaken by Reclamation and DWR. The Service believes the following reasonable and prudent measure is necessary and appropriate to minimize take of the Sacramento splittail.

(1) Minimize take at the Tracy and Skinner Fish Facilities.

The terms and conditions that implement the reasonable and prudent measure are the following:

(1) CVP and SWP shall use the following table (Table 5) to calculate take at the CVP and SWP Fish Salvage Facilities. If reasonable operation of the CVP and SWP cannot satisfy this requirement, the Working Group (defined in the Reporting Requirements section below) shall meet to develop alternative actions.

Table 5. The monthly average salvage at the Federal and State Fish Facilities from 1980 to 1992 by water year type. Numbers are allowable incidental take for each month by water year type.

Months	Above Normal	Below Normal
January	13,972	10,905
February	28,814	11,480
March	10,170	8,170
April	20,896	12,897
May	470,770	50,057
June	292,900	35,584
July	80,960	9,928
August	36,807	7,017
September	3,553	1,126
October	559	273
November	152	772
December	1,329	2,039

Biological Justification: These are average combined salvage numbers for the Tracy and Skinner Fish Facilities from 1984 through 1992. This period was selected because the Sacramento splittail was declining in numbers and so it represents a conservative limit. These numbers may be higher than delta smelt numbers without a deleterious effect on the abundance of the Sacramento splittail because this species may be successfully salvaged with up to 50 percent of fish surviving the handling and transport to the release site.

Reporting Requirements

Reclamation and DWR shall require all contractors, constituent farmers and salvage operation personnel at the State and Federal fish screens to report immediately any information about take or suspected take of delta smelt (and Sacramento splittail should this species be listed). Reclamation/DWR shall immediately notify the Service within 1 working day of any such information. Notification must include the date, time, and precise location of the incident and specimen, and any other pertinent information. The Service contact persons are Robert Pine and Matt Vandenberg at (916) 978-4613 and (916) 978-4866, respectively. Any killed specimens that have been taken shall be properly preserved in accordance with the Natural History Museum of Los Angeles County policy of assessioning (10% formalin in quart jar or freezing). Information concerning how the fish was taken, length of the interval between

death and preservation, the water temperature and outflow/tide conditions, and any other relevant information shall be written on 100% rag content paper and included in the container with the specimen. This preserved specimen shall be delivered to the Service's Division of Law Enforcement at 2800 Cottage Way, Sacramento, California 95825-1846 (telephone 916-978-4861).

When delta smelt are present, salvage information from the State and Federal fish protection facilities shall be faxed (916-978-4619) to the Service on Monday of each week or when the 14-day running average of combined salvage is at 400. If the 14-day running average of combined salvage is at 400 or above, Reclamation and DWR shall notify the Service within 48-hours about the proposed action to be taken to reduce salvage numbers.

The Service shall be notified within 48 hours when diversions are reduced at Barker Slough due to the presence of delta smelt juveniles and larvae, and when diversions are subsequently increased due to the absence of delta smelt juveniles and larvae. Numbers of Sacramento splittail sampled shall also be included in these reports. Flow reports from the Barker Slough intake in North Bay Aqueduct shall be submitted weekly to the Service by fax at (916) 978-4619.

All Rock Slough studies initiated in the February 4, 1994, delta smelt biological opinion shall be continued and the reporting requirements shall be the same.

The location of X2 in relation to Roe Island, Chipps Island, and Collinsville shall be monitored and related to the Delta 14-day running mean outflow, and DFG surveys that determine delta smelt abundance. Fax (916-978-4619) maps to the Service showing X2 location, Delta 14-day running mean outflow, 14-day running average salvage at CVP/SWP pumps, and the latest DFG survey information immediately when survey information is available in the following months: June, July, September, October, November, and December or once a month in other months.

Establishment of a Working Group and Management Group

The Service, NMFS, Reclamation, EPA, DWR, SWRCB, and DFG shall identify participants from each agency that will form two separate committees, a Management Group defined in Exhibit B of the Framework Agreement and a Working Group. The purpose of the Management Group shall be to recommend appropriate actions to the Service within a 7-day timeframe, assist in coordinating agency actions and resolving management conflicts, and to protect the delta smelt and other Federal and State listed endangered and threatened species. The purpose of the Working Group is to resolve biological and technical issues raised by this biological opinion and to develop recommendations for consideration of the Management Group. The Service shall convene the Working Group on a regular basis and will consider requests from agency participants at other times. The Management Group shall meet as necessary as recommended by the Service, Reclamation, and DWR.

CONSERVATION RECOMMENDATIONS

Sections 2(c) and 7(a)(1) of the Act direct Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species and the ecosystems upon which they depend. Conservation recommendations are Service suggestions regarding discretionary agency activities to promote the recovery of listed species. Therefore, the Service recommends the following additional actions to promote the recovery of federally listed species and their habitats:

(1) Reclamation and DWR, in cooperation with the IEP and other interested parties, should develop a program for threatened and endangered species that allows acquisition and management of areas used as spawning habitat, such as backwater sloughs and shallow channel edges, to prevent destruction and adverse effects caused by in-Delta project activities.

(2) Reclamation and DWR, in cooperation with the IEP and other interested parties, should develop baseline information (i.e., proposed operations plus February 12, 1993, winter-run chinook salmon biological opinion) on project effects on currently unlisted species including longfin smelt, Sacramento splittail, and green sturgeon to prepare for compliance with the Act as new species become listed.

(3) Reclamation and DWR, in cooperation with the IEP and other interested parties, should develop an ecosystem-centered analysis of the Bay-Delta to promote understanding of the interrelated effects of operating the Federal and State water projects.

(4) Reclamation and DWR should develop salinity standards for the Suisun Marsh that reflect the historical fresh to salt water gradient from east to west, and north to south within the marsh.

Because this biological opinion has found jeopardy, Reclamation is required to notify the Service of its final decision on the implementation of the reasonable and prudent alternative.

CONCLUSION

This concludes the conference for the proposed action. You may ask the Service to confirm the conference opinion as a biological opinion issued through formal consultation if the Sacramento splittail is listed and/or if critical habitat is designated for the delta smelt. The request must be in writing. If the Service reviews the proposed action and finds that there have been no significant changes in the action as planned or in the information used during conference, the Service will confirm the conference opinion as the biological opinion on the project and no further section 7 consultation will be necessary.

The incidental take statement provided in this conference opinion does not become effective until the species is listed and the conference opinion is adopted as the biological opinion issued through formal consultation. At that time, the project will be reviewed to determine whether any take of the Sacramento splittail has occurred. Modifications of the biological opinion and incidental take statement may be appropriate to reflect that take. No take of the Sacramento splittail may occur between the listing of the species and the adoption of the conference opinion through formal consultation, or the completion of a subsequent formal consultation.

This concludes formal consultation on proposed operations of the CVP and the SWP as described above. As required by 50 CFR 402.16, reinitiation of formal consultation is required if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an adverse effect to the listed species or critical habitat that was not considered in this biological opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take ceases to have the protective coverage of section 7(o)(2) of the Act.

If you have any questions regarding this biological opinion, please contact Joel Medlin, Field Supervisor, at the Sacramento Field Office at (916) 978-4613.

Sincerely,

Regional Director

cc: Sacramento Field Office, Sacramento, California

Department of Fish and Game, Bay-Delta Special Water Projects Division, Attention: Dale Sweetnam, 4001 North Wilson Way, Stockton, California 95205-2424

U.S. Environmental Protection Agency, Region II, Attention: Bruce Herbold, 215 Fremont Street, San Francisco, California 94105

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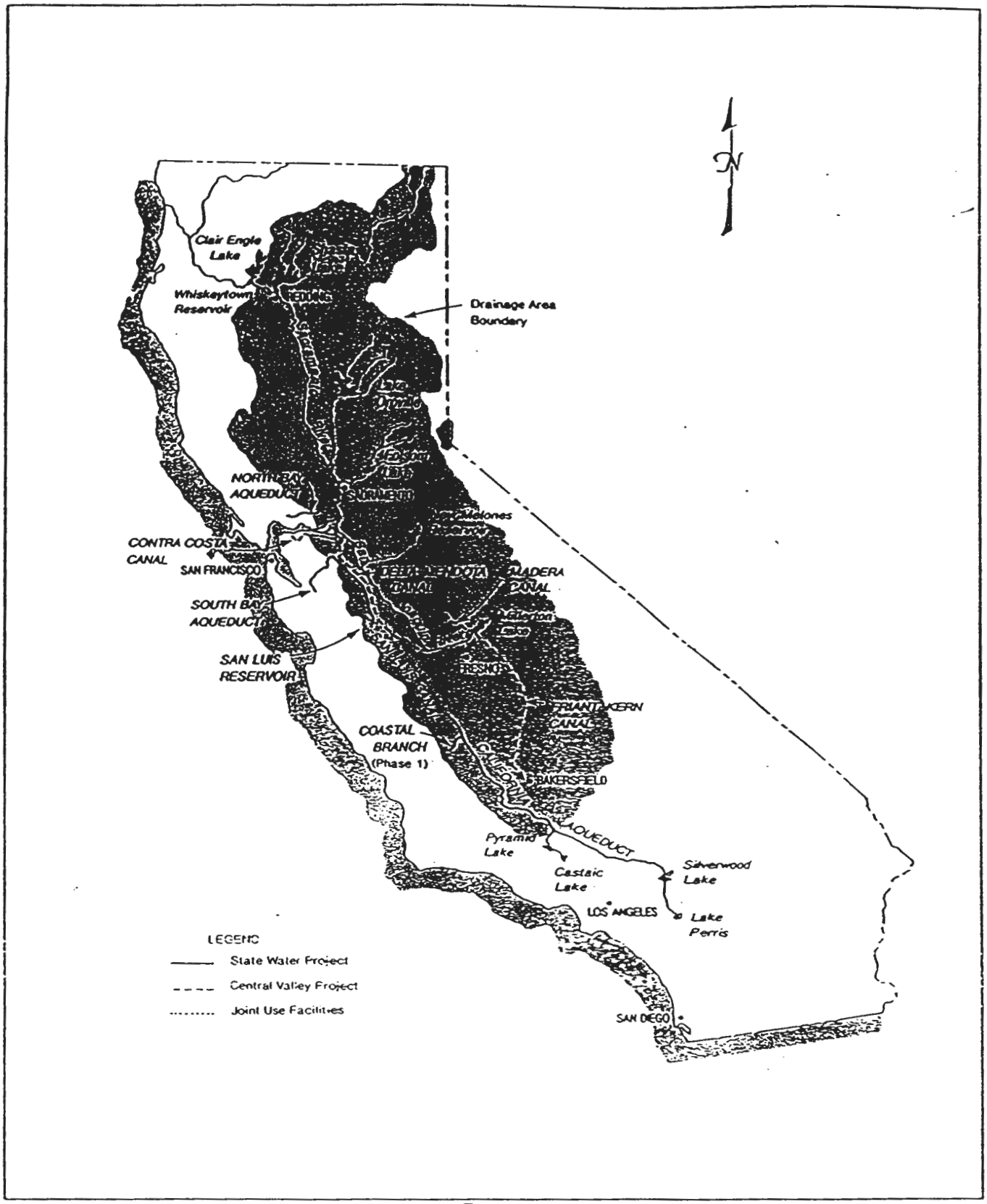


Figure 1.
MAJOR FEATURES OF THE CENTRAL VALLEY PROJECT AND STATE WATER PROJECT

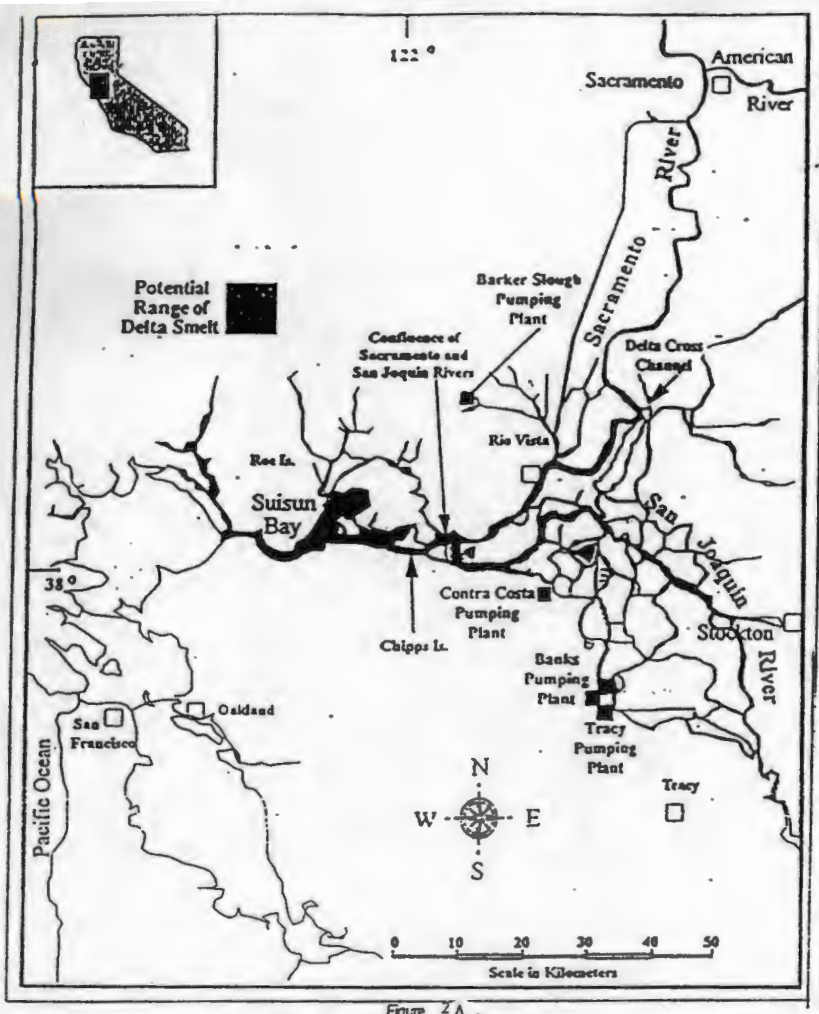


Figure 2a.
SACRAMENTO-SAN JOAQUIN ESTUARY
Adapted from Sweetnam and Stevens 1992.

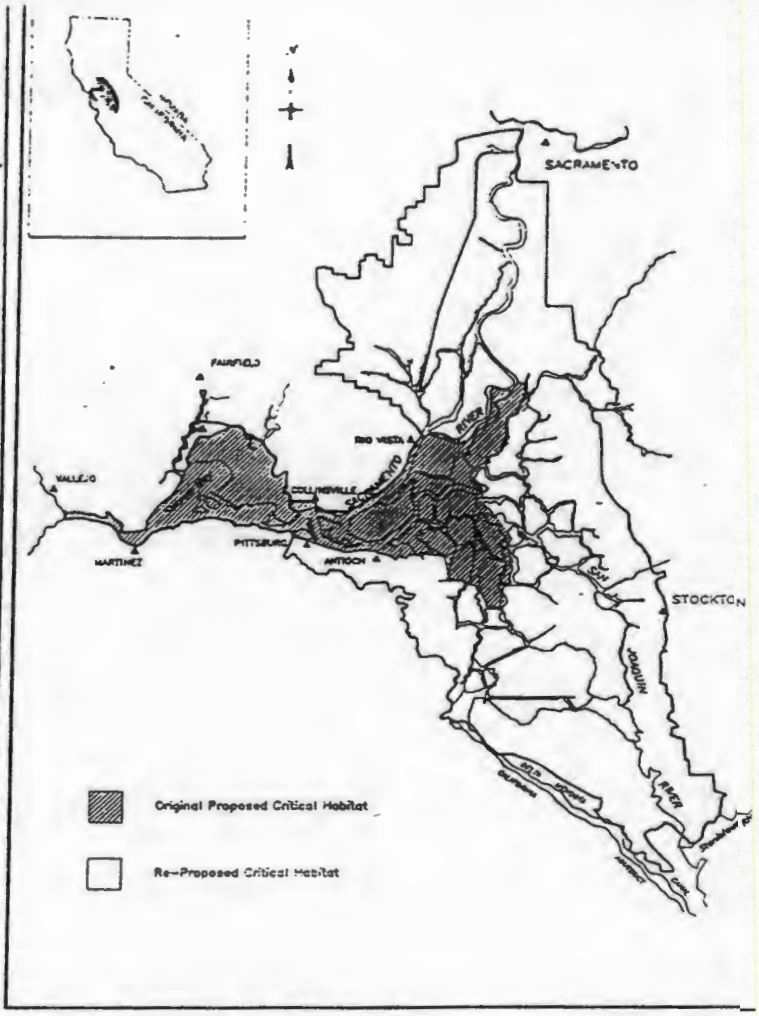


Figure 2b.

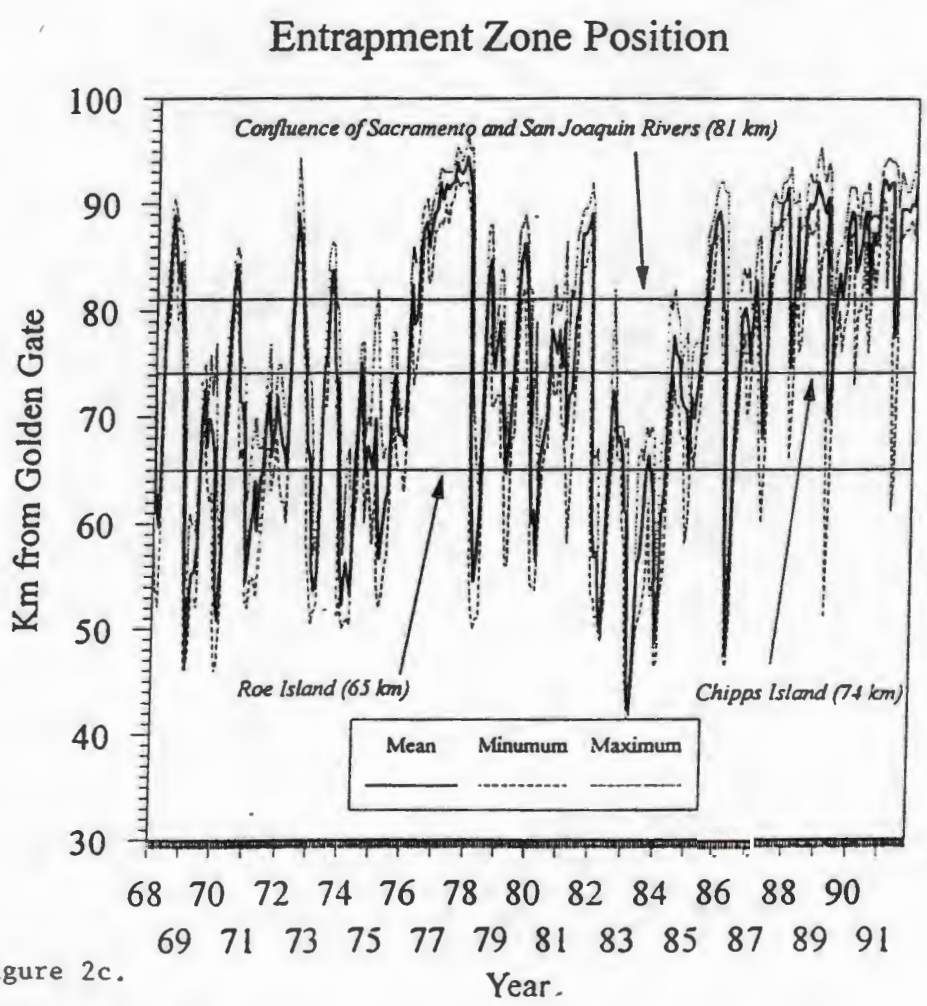
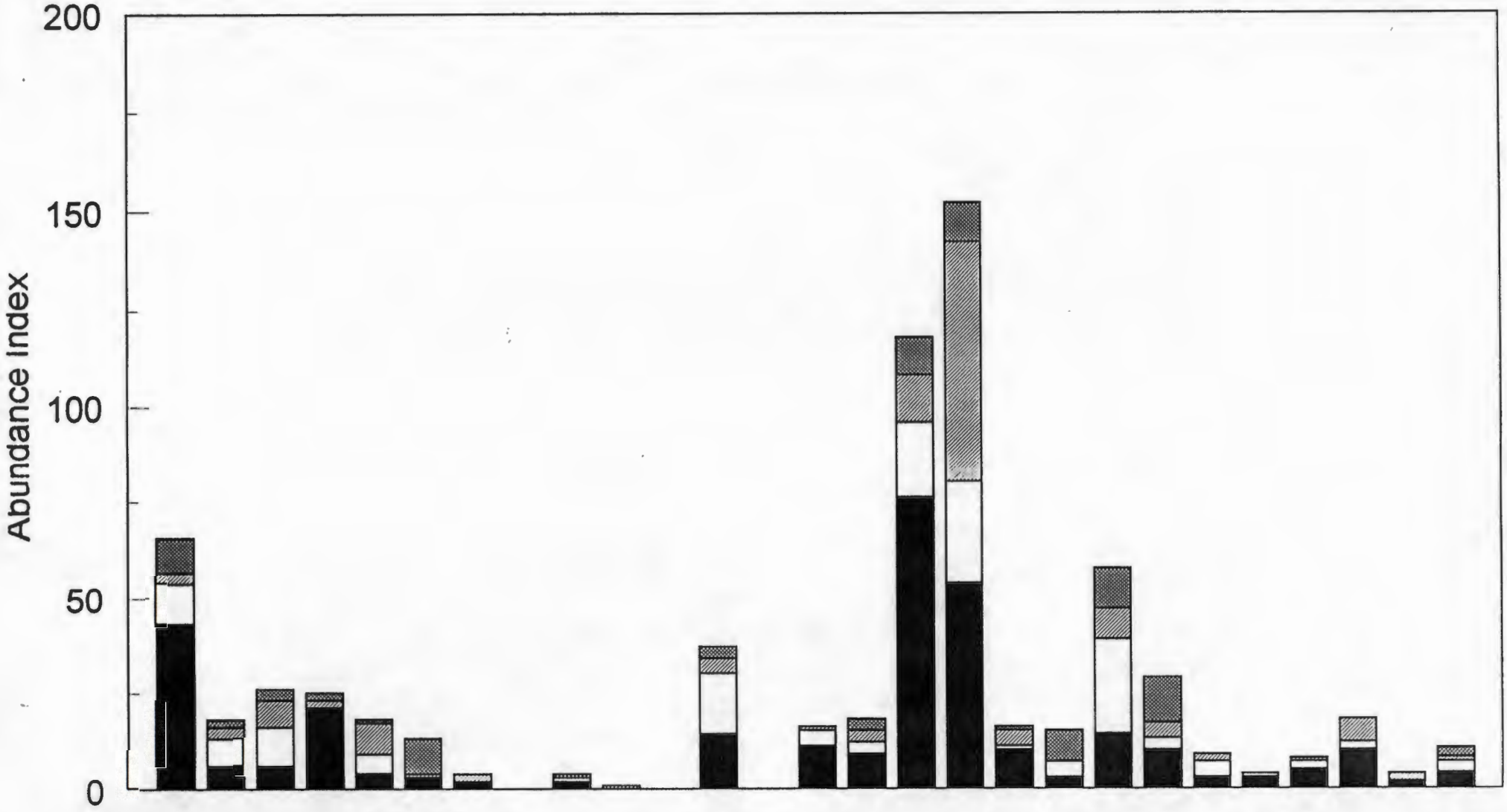


Figure 2c.

Figure 3.

Splittail Fall Midwater Trawl Abundance Index



Year	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93
Sep ■	43.0	6.0	6.0	21.0	4.0	3.0	2.0		2.0	0.0	0.0	14.0		11.0	9.0	76.0	54.0	10.0	3.0	14.0	10.0	3.0	3.0	5.0	10.0	2.0	4.2
Oct □	11.0	7.0	10.0	0.0	5.0	0.0	0.0		1.0	0.0	0.0	16.0		4.0	3.0	20.0	26.0	1.0	4.0	25.0	3.0	4.0	1.0	2.0	2.0	0.0	2.8
Nov ▨	3.0	3.0	7.0	2.0	8.0	1.0	2.0		0.0	1.0	0.0	4.0		1.0	3.0	12.0	62.0	4.0	0.0	8.0	4.0	2.0	0.0	1.0	6.0	2.0	1.2
Dec ▩	9.0	2.0	3.0	2.0	1.0	9.0	0.0		1.0	0.0	0.0	3.0		0.0	3.0	10.0	10.0	1.0	8.0	11.0	12.0	0.0	0.0	0.0	0.0	0.0	2.4
ANNUAL	66.0	18.0	26.0	25.0	18.0	13.0	4.0	0.0	4.0	1.0	0.0	37.0	0.0	16.0	18.0	118.0	152.0	16.0	15.0	58.0	29.0	9.0	4.0	8.0	18.0	4.0	10.6

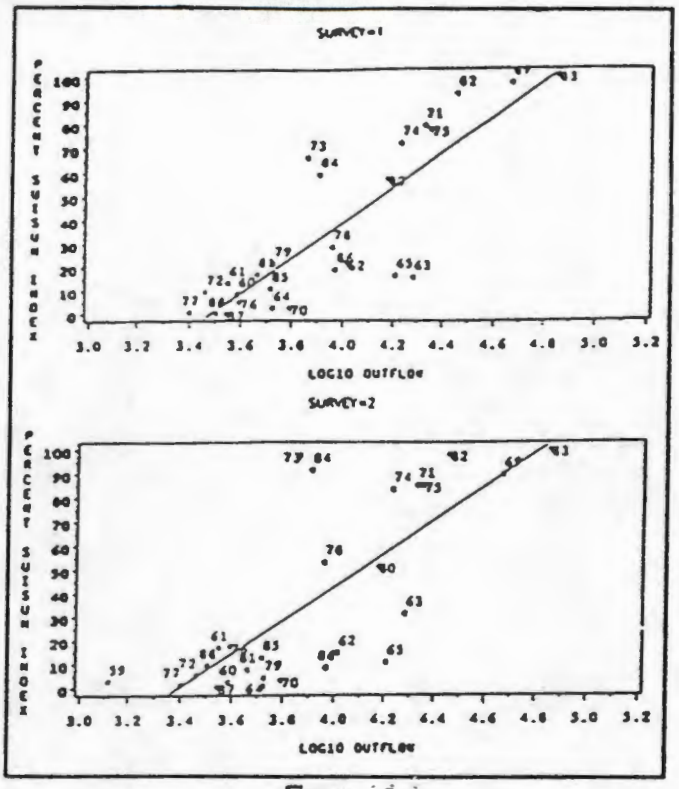


Figure 4a.
RELATIONSHIP BETWEEN THE PORTION OF DELTA SMELT POPULATION WEST OF THE DELTA AND LOG DELTA OUTFLOW DURING THE SURVEY MONTH FOR SUMMER TOW-NET SURVEY, 1959 TO 1988
For arcsine transformed percentages, $r^2 = 0.74$ for survey 1 and $r^2 = 0.55$ for survey 2.
Source: Sweetnam and Stevens 1993.

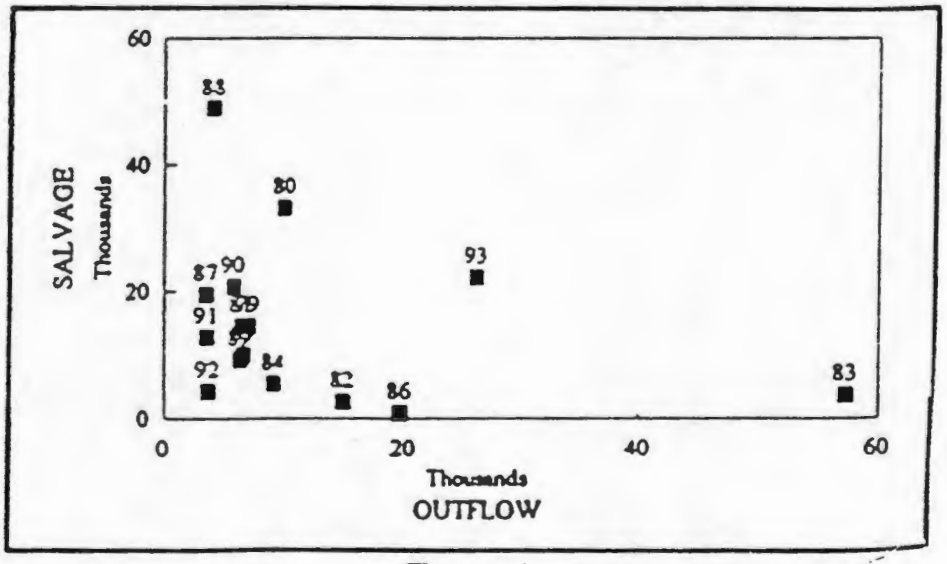


Figure 4b.
RELATIONSHIP BETWEEN EXPANDED SALVAGE OF JUVENILE DELTA SMELT AT SKINNER FISH FACILITY AND TOTAL DELTA OUTFLOW, 1979-1993

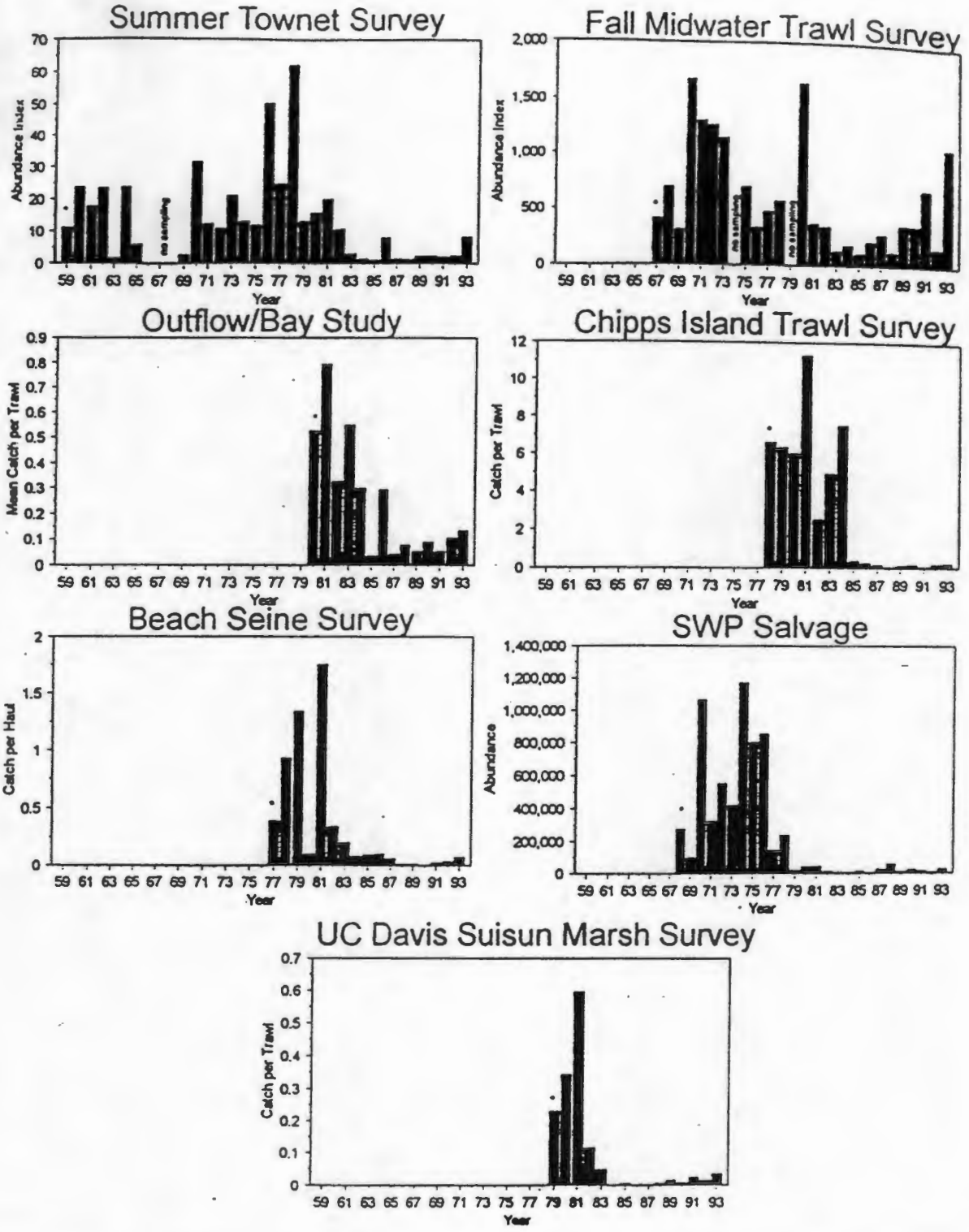


Figure 5.

TRENDS IN DELTA SMELT POPULATIONS, AS INDEXED BY SEVEN INDEPENDENT SURVEYS

Note that not all surveys were conducted in all years shown.

Source: Department of Fish and Game, updated from Stevens *et al* 1990.

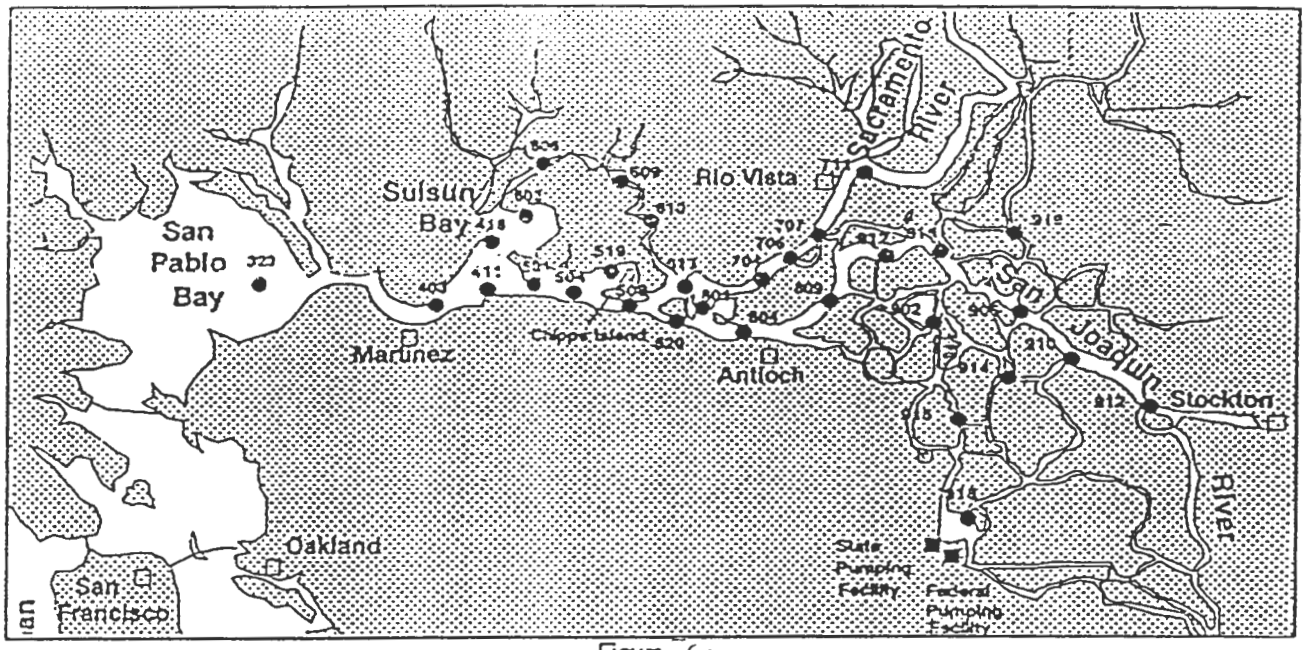


Figure 6a.

SUMMER TOW-NET SURVEY SAMPLING SITES IN THE SACRAMENTO-SAN JOAQUIN ESTUARY

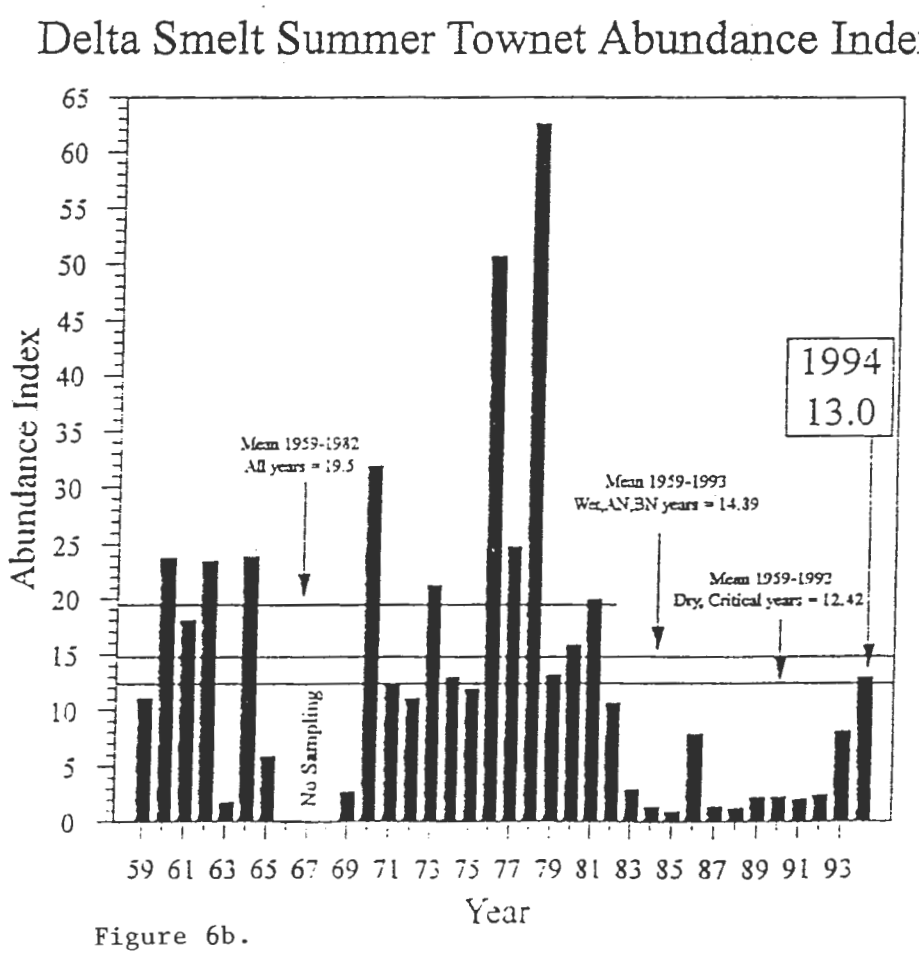


Figure 6b.

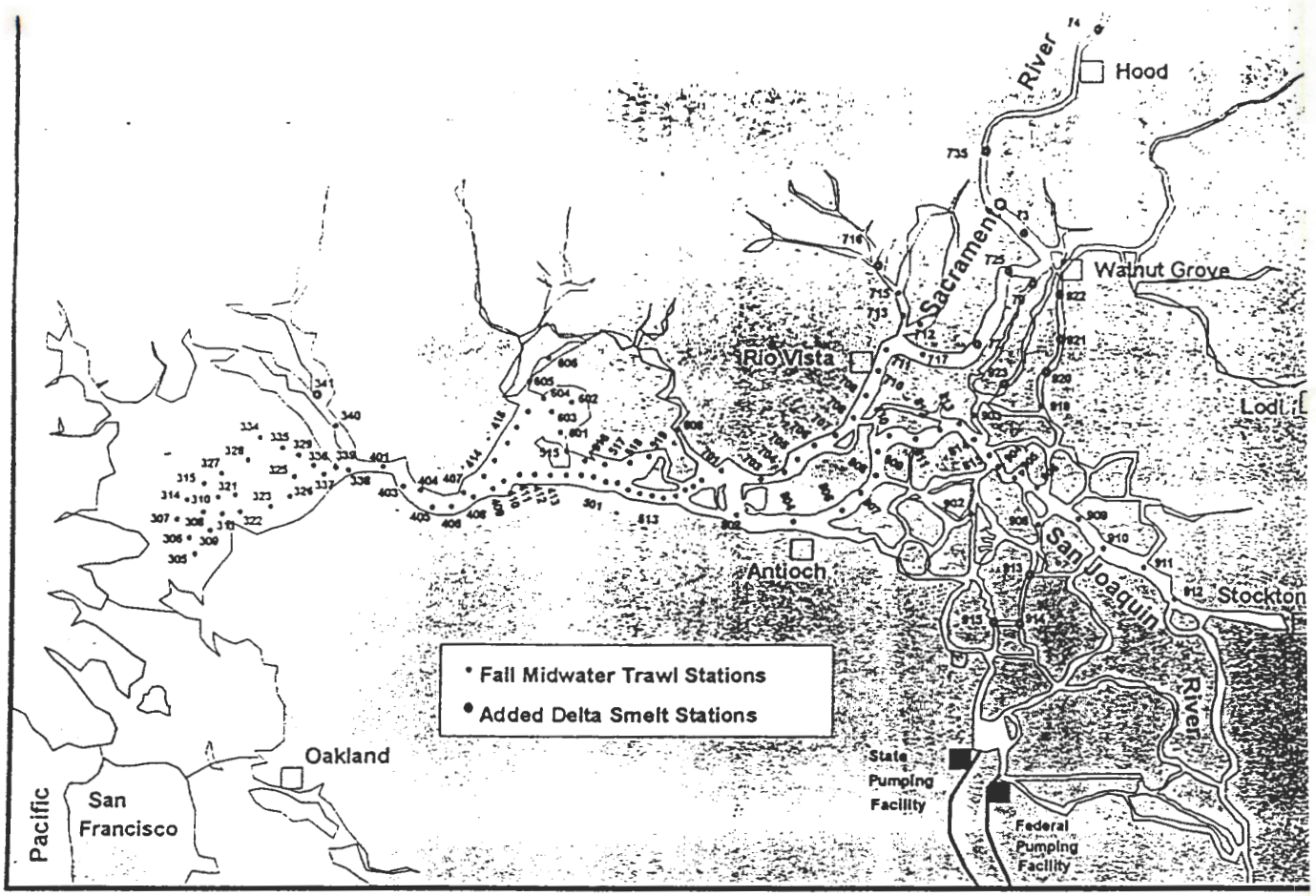
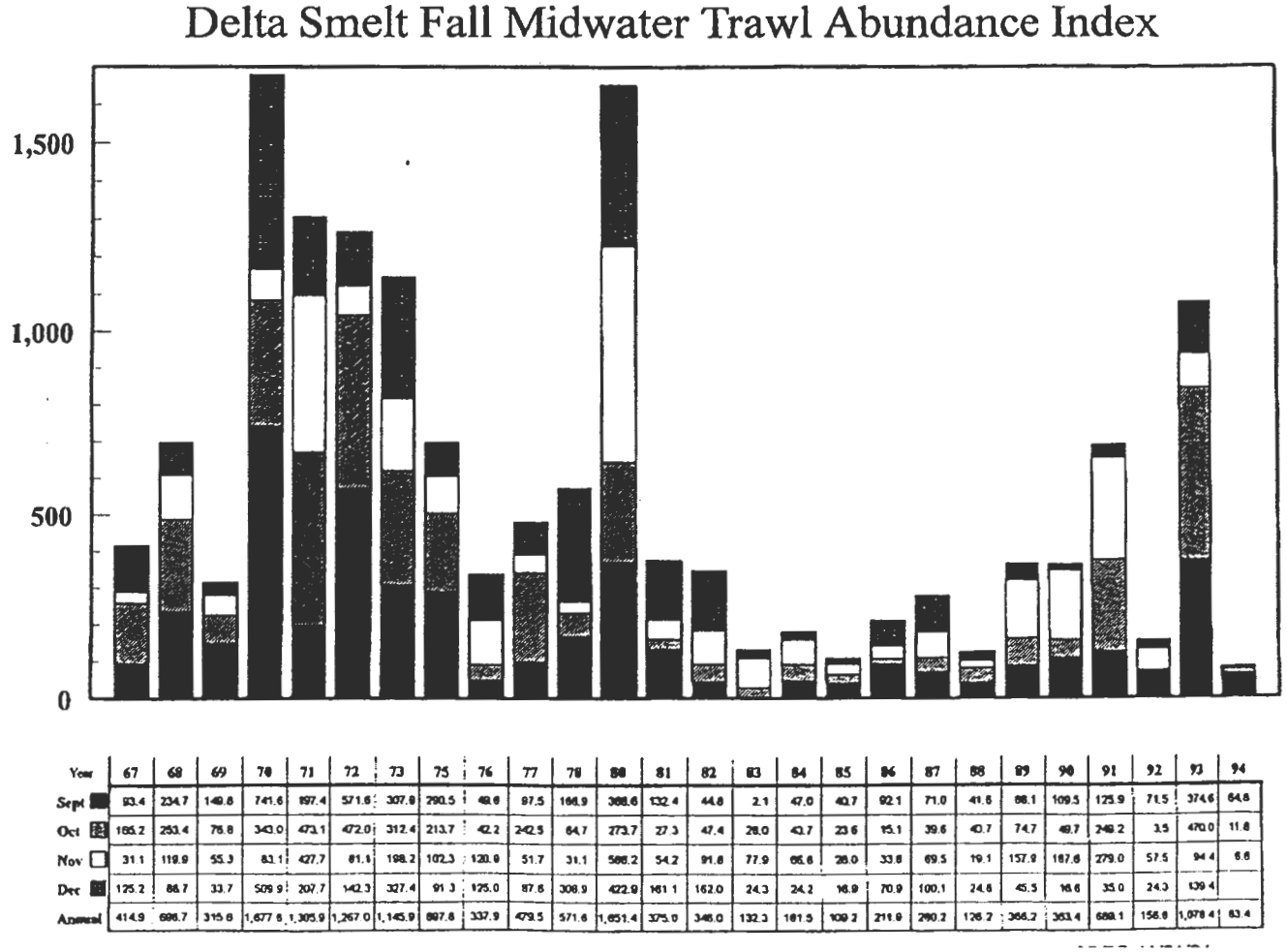


Figure 7a. Fall midwater trawl sampling sites in the Sacramento-San Joaquin Estuary.



Year	67	68	69	70	71	72	73	75	76	77	78	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94
Sept	93.4	234.7	149.8	741.6	897.4	571.6	307.8	290.5	49.6	97.5	166.9	368.6	132.4	44.8	2.1	47.0	40.7	92.1	71.0	41.6	88.1	109.5	125.9	71.5	374.6	64.6
Oct	185.2	253.4	76.8	343.0	473.1	472.0	312.4	213.7	42.2	242.5	64.7	273.7	27.3	47.4	28.0	43.7	23.6	15.1	39.6	40.7	74.7	48.7	248.2	3.5	470.0	11.8
Nov	31.1	119.9	55.3	83.1	427.7	81.1	198.2	102.3	120.9	51.7	31.1	568.2	54.2	91.8	77.9	66.6	28.0	33.8	69.5	19.1	157.9	187.6	279.0	57.5	94.4	6.6
Dec	125.2	88.7	33.7	509.9	207.7	142.3	327.4	91.3	125.0	97.6	308.9	422.9	161.1	162.0	24.3	24.2	16.9	70.9	100.1	24.6	45.5	16.6	35.0	24.3	139.4	
Annual	414.9	696.7	315.6	1,677.6	1,305.9	1,267.0	1,145.9	697.6	337.9	479.5	571.6	1,651.4	375.0	346.0	132.3	181.5	109.2	211.9	280.2	126.2	366.2	363.4	688.1	156.8	1,078.4	83.4

Figure 7b. Fall midwater trawl index showing decline from 1981 to 1992. Note increases in 1991 and 1993.

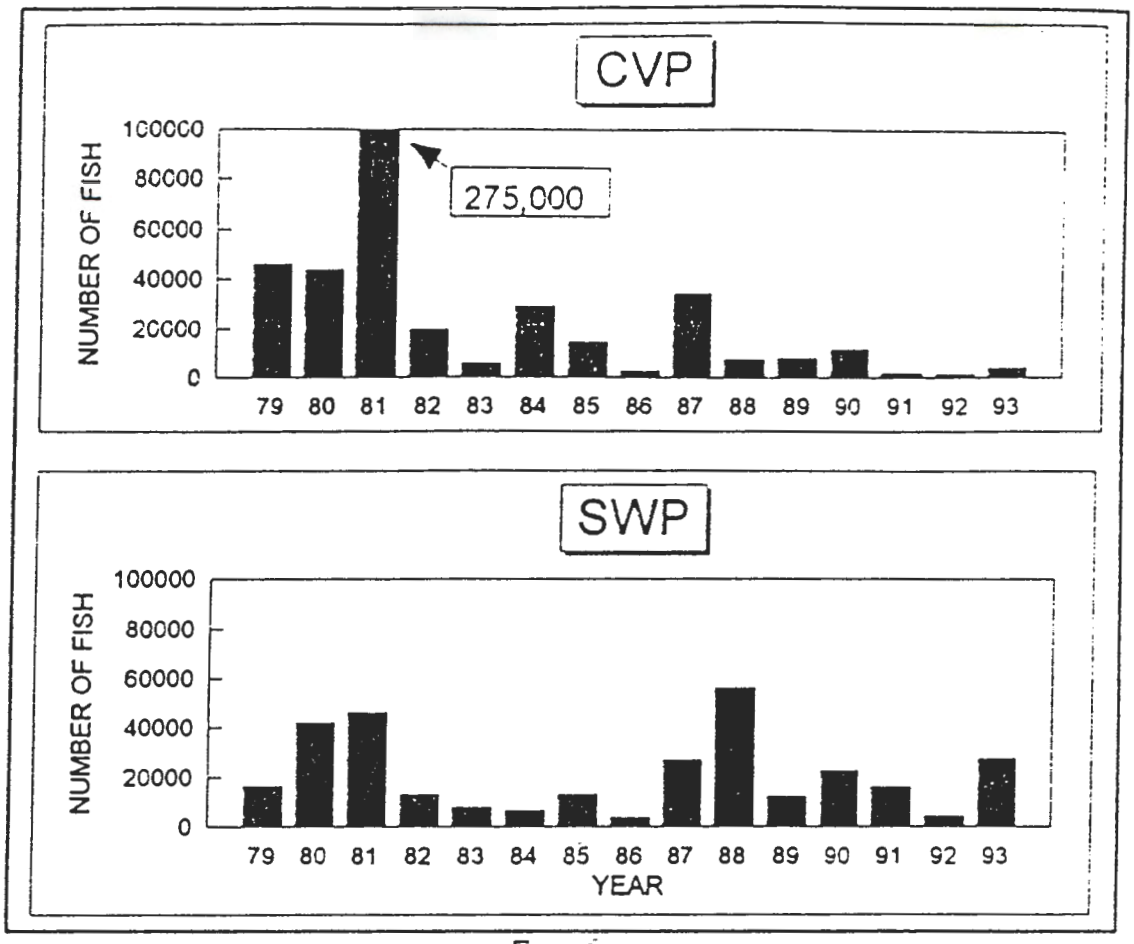


Figure 8.
ANNUAL SALVAGE ESTIMATES FOR DELTA SMELT AT THE CVP AND SWP FISH FACILITIES
Data before 1979 are not included because of identification problems described in the text.

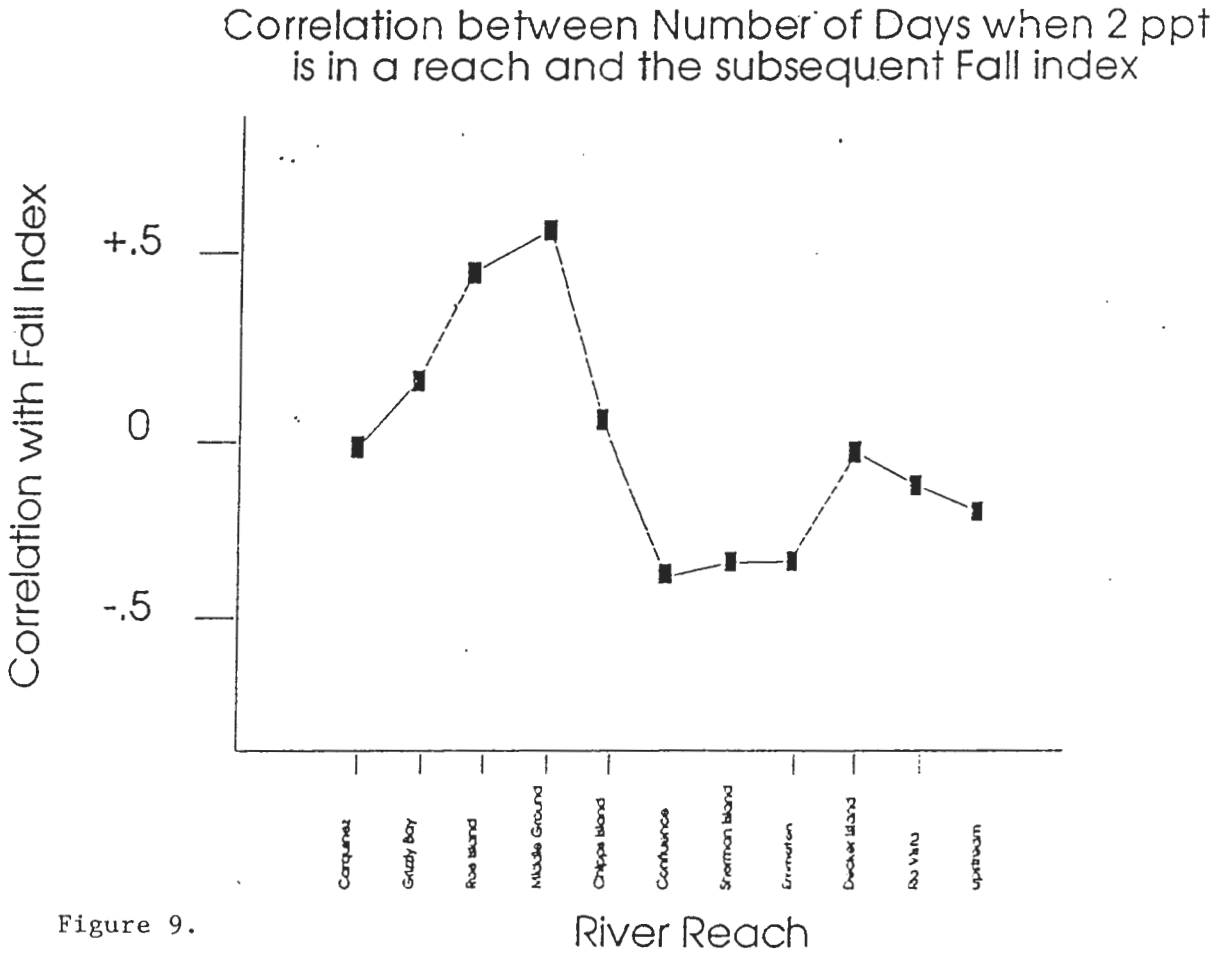


Figure 9.